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BRITAIN'S LEADING AIR POLLUTION JOURNAL

CLEAN AIR

incorporating "Smokeless Air"

SPRING 1971

VOL. 1 NO. 1

PRINCIPAL CONTENTS

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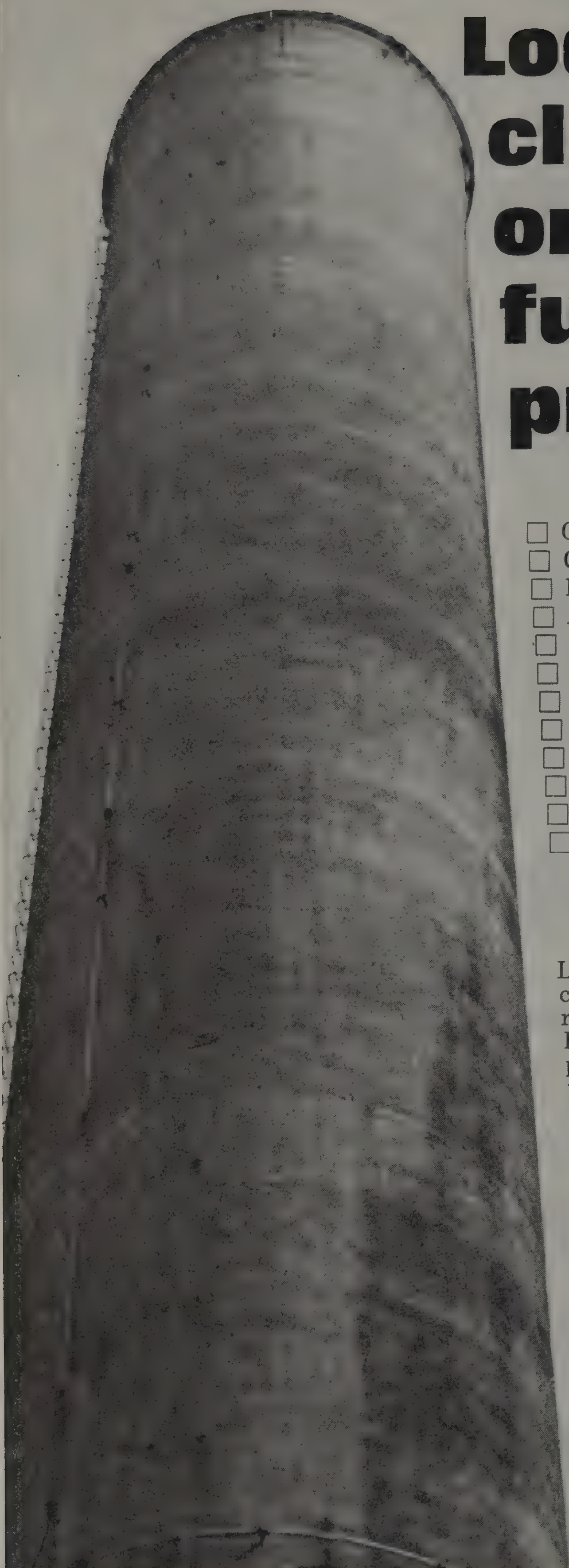

CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

Vol. 1 No. 1 **Spring 1971**

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ABC

"This most excellent canopy, the air"

CLEAN AIR

This spring sees the start of a new era for our journal. Not only has it been changed in format and layout to conform with present thinking, but its name has been changed from Smokeless Air to Clean Air; this gives a wider meaning than the old one. Some years ago the Society changed its name to the National Society for Clean Air, in a similar manner. Now it is time for the journal to change its name.

This Society, as its name clearly states, is concerned not only with smokeless air but with clean air in all its aspects. Smokeless air is a part only, albeit a very important part, of clean air; but the time has now arrived when we as a Society must look over much wider horizons.

In this country we are all aware that much has been done and much is being done to clean our air. Much of this, largely due to the efforts of many of our members, has been directed to the abatement of smoke. That this policy has been successful, and that this work has been brought to fruition, is now seen daily in our larger cities where there is more sunshine, where plants and flowers of all kinds now grow where previously there was only privet and laurel, where birds of many more varieties are now to be seen, and where it has been worthwhile to clean buildings. But as the smoke has abated, so other pollutants have become very much more obvious—grit and dust, sulphur dioxide and odours to name but a few.

These now more obvious pollutants give some indication of the task that lies ahead of us as a Society. We have got to raise our sights and broaden our vision. The problems that remain, and we still have not yet got rid of all the smoke, are complex. For example, we do not know enough about the problem of sulphur dioxide. We know it is corrosive and damages metals and has a deleterious effect on plant life. But how dangerous is it and what are its effects on human beings? Is the policy of high stacks, which we use in this country for its dispersal, enough? Should we start thinking about a policy of desulphurisation of fuels or should we be looking for a viable and economical means of the recovery of sulphur from flue gases? These are just a few of the questions which have still be to answered.

The problem of pollution from motor cars is no new one, but we still have no legislation to control it. The Society has been pressing for a very long time for legislative action to be taken and we have been promised that some such action may be taken soon. But will it be enough? It has been said that photochemical smog cannot happen here. It is to be hoped that this is true. But is it? Because of the cleaner air which we now all enjoy there is much more sunshine in our cities, summer temperatures have been somewhat higher than in previous years and although this may lead to increased turbulence, there are some experts who say that on occasions they have already detected the first signs of photochemical smog in our busy city streets.

The problem of pollution from aircraft is another one about which we do not yet know enough. Much thought is being turned to this and this will be discussed at our forthcoming Conference in Folkestone. The problem of odours is another one. Smells, somehow, these days seem to be becoming more apparent. There is no easy answer to this problem and in some cases the only effective palliative is to make certain that a plant emitting unpleasant odours is not situated near a residential area. But only recently three instances have been brought to our notice where properties in residential areas have been turned over to factories which cannot help producing odours. In one instance a school has been turned into a factory making electric light fittings. In another, a large garage was turned into a factory for food processing; and in another, a farmhouse in the middle of a village has been turned into a plant for rendering down fats. These would indicate bad planning and it is along such lines that we have got to start to do more work. While we are busy cleaning up the pollution that already exists, we must take care that in our planning for the future proper provision is made to see that new forms of pollution are prevented.

For many years this journal has used some words from Wordsworth's immortal sonnet "Upon Westminster Bridge" at the start of its editorial. Now, as we turn from Smokeless Air to Clean Air, we turn to Shakespeare and will use "This most excellent canopy, the air", Whenever we see this we should remember that Hamlet says rather more about the air than this. He says "This most excellent canopy, the air,—this brave o'erhanging firmament, this majestical roof fretted with golden fire,—why, it appears no other thing to me but a foul and pestilent congregation of vapours". This outlines our task. It must be our endeavour to ensure that the "excellent canopy" is not allowed to become a "foul and pestilent congregation of vapours". And to do this, we are going to have our work cut out.

The Cost of Living

At the time of writing there is a Post Office strike in progress, there is a strike at Ford's Motor Works, there is a threat of a railway strike and all around us there are claims for higher wages. Last year there were wage awards in most branches of industry including the printing industry which affects the Society very closely. All these wage awards, all these demands are connected with the cost of living generally. We, as a Society, are equally involved and our cost of living has gone up just like that of everybody else.

As a result, it became necessary last year to put to an Extraordinary General Meeting, which was held on Thursday, 22nd October at Southport, during Conference, a resolution increasing subscriptions right across the board. No-one regrets having to do this more than the Council. But last year, operating costs rose by over 20%. Although economies have been effected by the movement of the headquarters to Brighton and the re-organisation of the staff, these cannot entirely keep pace with constantly rising costs and we shall have to ask our members to subscribe more.

We hope that all our members will continue to support us and pay their increased subscriptions as cheerfully as possible.

Details of the new subscriptions, due on 1st April, appear on page 9.

The Royal Commission on Environmental Pollution

The Royal Commission published its First Report on the 23rd February 1971. This is certainly both interesting and instructive and we unhesitatingly recommend that all our members should obtain a copy of the report and read it for themselves. The report serves to put the whole problem of pollution and its control into perspective. It recognises that there are economic factors which have to be considered as well as the fact that some of our resources are limited. But "the difficulties of obtaining precise scientific measures of the relationship between the costs and the benefits must not provide a pretext for failure to analyse individual pollution problems".

"Much has already been done in Britain, and is being done, to safeguard our environment, but there is no ground for complacency. There is a need for objective and realistic advice on the difficult choices which must be made in deploying limited resources." The report recognises the part that the rapid increase in population and the consequent increase in the use of energy have to play, and notes that these are considerations which are probably outside the Commission's terms of reference.

The Royal Commission welcomes the success of the clean air policy which "is encouraging but more needs to be done to apply this policy throughout the country and to enquire into the effects of pollutants from road vehicles. There are possible effects of atmospheric pollution on global weather and climate." These global effects are dealt with at some length, and although the members of the Royal Commission see no cause for alarm they recommend "the extension of international monitoring of the atmosphere and the maintenance and extension of fundamental research on an international basis on the natural and physical processes, both within the atmosphere and between the atmosphere and the surface of the planet".

In the coming year the Commission propose that they should first enquire into, and report on, the problems of the pollution of tidal waters, estuaries and the seas around our coasts. They also consider that they should keep under review action to improve Britain's rivers. And they conclude by recommending that the Government should make suitable arrangements for a start to be made on a study of the costs of different degrees and kinds of pollution and pollution abatement.

The Conference and Exhibition

In December 1969 the Executive Council decided that after 1970 the Exhibition should be held every two years in a large centre of population, and that in the alternate years the Conference would be held without the Exhibition.

1971 is a non-Exhibition year and therefore the Conference will be held on its own at Folkestone from the 2nd to 5th November. Members are particularly asked to note that the date is early in November and not, as usual, in October.

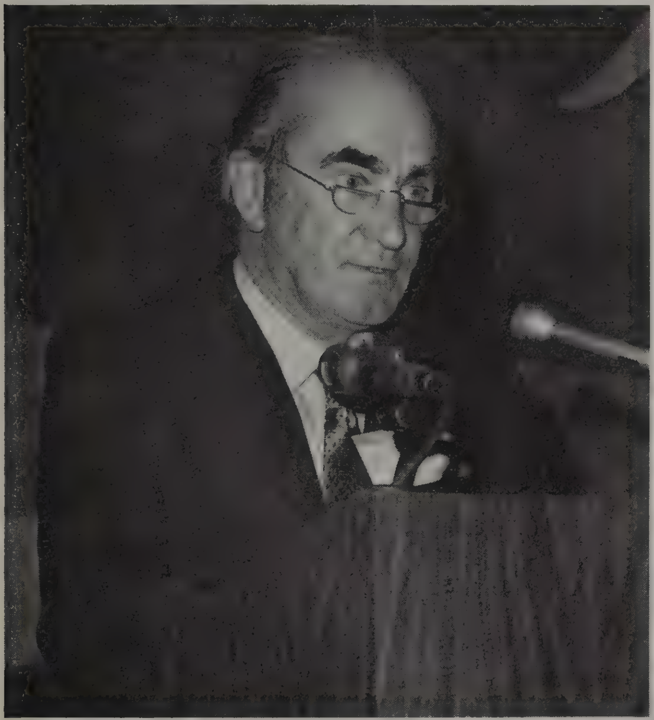
1972 will be the Conference and Exhibition year, but with a difference. The Society is promoting a large international Exhibition at Belle Vue, Manchester from the 7th to 11th February, 1972. In conjunction with this Exhibition will be staged a series of technical symposia. In October 1972 the Annual Clean Air Conference will be held at Scarborough—but without an Exhibition.

These are important changes which, in effect, mean that there will be a Clean Air Conference every year and every second year there will be a separate Clean Air Exhibition. We suggest that all readers should make a note of these important dates now.

2nd International Clean Air Congress

Washington 6—11th December, 1970

The 2nd International Clean Air Congress was held at the Sheraton Park Hotel, Washington, from the 6-11 December, 1970. The Congress was attended by some 2,500 delegates from 37 nations; over a period of four days, 256 papers from some 560 authors were presented and discussed at as many as six simultaneous sessions, almost all of which were well attended by attentive audiences. This serves to demonstrate the explosive growth of world-wide interest in problems of atmospheric pollution.



Sir Kenneth Hutchison addresses the opening session

More than three-quarters of the papers presented had a substantial scientific value, even though as is often the case in this type of conference, some of the material had been published elsewhere and some papers described highly speculative processes in the hope of possibly attracting official grants for further research. Discussions of administrative and policy problems were listened to with interest, but the objective of cleaning up the atmosphere was never in doubt; it was only a question of how to achieve the desired end.

The Congress was sponsored by the Air Pollution Control Association of the United States and Canada and planning for the Conference had been going on for nearly four years. Under a central Technical Programme Committee, National Programme Committees for the selection of papers were set up in forty-five countries. Among the subjects covered were chemistry and physics, meteorology, medicine and biology, control engineering and chemical engineering, surveys, and administration and legislation. The programme included something for everybody, the only difficulty being that with as many as six technical sessions going on simultaneously it was difficult for delegates to decide which session they would attend and which paper they wished to hear.

The Congress was opened with a keynote plenary session on the morning of Monday, 7 December, and the keynote address "Action for the 70s—Environmental Protection" was given by Mr. William D. Ruckelshaus, the newly appointed administrator to the Environmental Protection Agency of the United States of America. This keynote address was followed by reports from member associations of the International Union of Air Pollution Prevention Associations and reports were received from U.S.A. and Canada, Argentine, Mexico, France, Australia, Japan, Switzerland, West Germany and Great Britain. The paper on the work of our own National Society for Clean Air was presented by our President, Sir Kenneth Hutchison, C.B.E., F.R.S.

At 2 o'clock on the Monday afternoon the first of the forty-two technical sessions opened and these continued until the end of the Thursday afternoon. The Conference closed on the morning of Friday, 11 December, with another plenary session which took the form of reports from international organisations—NATO, the World Health Organisation, the World Meteorological Association, the Organisation for Economic Cooperation and Development, the Commission of the European Communities and the United Nations.

Great Britain contributed twelve papers with at least one in every section. There is no doubt that these papers created a great deal of interest and it became apparent that America and the rest of the world have recognised, perhaps better than we have ourselves, that Great Britain has made a real and successful effort to combat air pollution; and other countries were very keen and anxious to learn how we have done this.

Concurrently with the Congress, there was a Film Festival showing films about clean air and the environment. There were awards for the best films in two classes and we are very happy to be able to report that the first prize for the best general film about the environment was awarded to "The Shadow of Progress" entered by the British Petroleum Company Limited. At the closing plenary session of the Congress the award was presented to Rear Admiral P. G. Sharp, the Director of the Society who received it on behalf of the Society and the British Petroleum Company Limited, one of its members.

On the platform at the opening session—Mexico, France, Australia, Japan and Great Britain

As well as the authors of papers, a number of other representatives of the Society and Great Britain attended the Congress, notably the President, Sir Kenneth Hutchison, C.B.E., F.R.S., and Mr. Stanley E. Cohen, C.B.E., the Honorary Treasurer and President Elect. One of the papers was presented by the Chairman of the Yorkshire Division, Mr. J. W. Batey, and Mr. F. E. Ireland the Chief Alkali Inspector, Dr. S. R. Craxford of Warren Spring Laboratory, and Professor P. J. Lawther of the Medical Research Council, also spoke.

A section of the British Joint Venture Stand

In addition to the very full programme of technical sessions, there was considerable social activity. The Conference opened on the Sunday evening with a "Pre-Conference Mixer" or informal gathering; there were official luncheons on the Monday, Tuesday and Thursday and there was an official banquet on the Wednesday evening. On the Wednesday afternoon there was an outing to visit the White House for those delegates fortunate enough to be included in the limited number of places available. Those who were fortunate had a conducted tour of the White House, were received by Mrs. Nixon on behalf of the President of the United States, and very kindly entertained to tea.

Admiral Sharp receives the film trophy

The United States State Department were hosts at a cocktail party on the evening of Tuesday, 8 December, and a reception for British delegates and exhibitors and their American friends was held in the British Embassy on Thursday, 10 December.

There was a very comprehensive social programme for the ladies, which they all enjoyed, and at a special ladies' session on the morning of Thursday 10th they discussed "Action for Environmental Improvement," and this proved to be one of the most successful sessions of the whole Conference.

The Exhibition which was held in the hotel, comprised some eighty-five exhibitors of whom four were from Great Britain. The Exhibition opened at noon on Sunday, 6 December, and closed at noon on Friday, 11 December. The British exhibitors were exhibiting under the aegis of the Board of Trade in a Joint Venture Stand sponsored by the Society. On this stand the Society had an Information Bureau which created a great deal of interest, at which we received many enquiries and from which we were able to sell a considerable amount of literature.

Undoubtedly, the Congress was on a considerable scale and was of high scientific quality. It had the declared intention to continue discussion on an international basis at the United Nations meeting on the environment in Stockholm in 1972, and the 3rd International Clean Air Congress due to be held in Germany in 1974. At Washington the Society was able to keep its end up, but only just. Washington served as a cogent reminder that the National Society for Clean Air must be so constituted that it can play an effective part in the international scene. This is going to become more and more important as time goes on. Clean air is a global responsibility which can no longer be dealt with in insularity.

Increased Rates of Subscription

At an Extraordinary General Meeting held in the Floral Hall, Southport at 9.30 am on Thursday 22nd October, 1970, the Special Resolutions and Ordinary Resolutions that the number of representatives and subscriptions should be increased were carried by a majority vote.

The new rates and numbers of representatives which come into force on 1st April 1971 are as follows:

Local Authorities

Population	£	
Less than 25,000	10	appointing 2 representatives
25,001 to 50,000	13	,, 2 ,,
50,001 to 75,000	17	,, 2 ,,
75,001 to 100,000	23	,, 3 ,,
100,001 to 175,000	35	,, 3 ,,
175,001 to 250,000	40	,, 4 ,,
250,001 to 375,000	45	,, 4 ,,
375,001 to 500,000	50	5 ,,

Over 500,000, £15 and 1 additional representative for each additional 1,000,000 of population or part thereof.

Corporate Bodies

£	
23	appointing 2 representatives
40	,, 4 ,,

Individual Members
3

Associate Members
3 minimum

It is hoped that as many Individual Members as possible will pay their subscription by Covenant, by which means the Society, as a registered charity, can recover income tax. Those members paying tax at the standard rate, which will be 39p in the £1, need only pay £1.83 each year provided that they do so by Covenant.

Modern Chimney Design

By Max Beaumont

A chimney has first to be designed operationally so that it will be as efficient as possible under all boiler loading conditions, and second it has to be designed so that its life span is economical. After that, it has to be designed structurally. Operational design is common to all chimneys, whether they be made of brick, concrete, plastic or steel. The structural design depends upon many factors but generally the most important of these are cost and aesthetics.

For optimum operational efficiency the flue gases should be discharged from the top of the chimney by the maximum possible gas velocity and at a height not less than that laid down in the Clean Air Act.

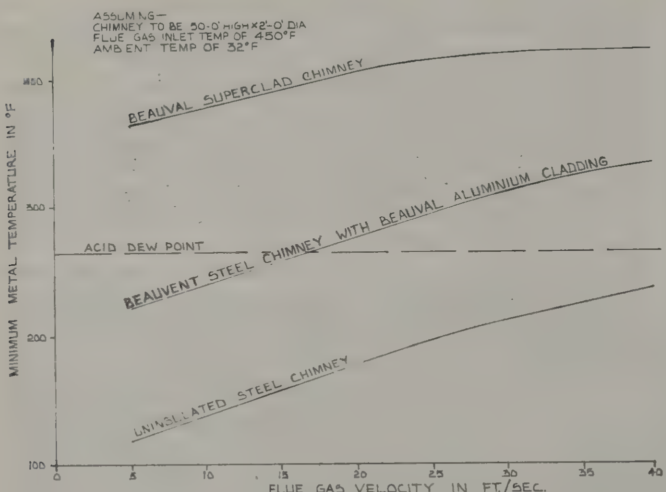


Figure 1

The life of a chimney depends mainly on the velocity and the temperature of the flue gases which should be discharged from the top of the chimney before they have had a chance to condense on its inner surface. If the gases do condense, acid attack will take place on the inner surface whatever the construction. The principle of acid condensate attack is well known; basically, if the gases cool to a temperature below their dew point, which is normally taken as 270°F., they condense into dilute sulphuric acid which will attack the surface of the chimney; but if this inner surface can be maintained above dew point, little or no attack will take place.

Figure 1 shows the effect of gas velocity on the temperature of the flue gases for a chimney 50ft high × 2ft diameter with a gas inlet temperature of 450°F. and an ambient temperature of 32°F. Three types of steel chimneys are shown; firstly, the uninsulated; secondly, the chimney with standard aluminium cladding with a ¼ in. static air gap between the surface of the steel and the aluminium, and thirdly, the superclad chimney which consists of 2 in. of mineral wool wrapped around the outside of the chimney, the mineral wool being protected from the weather by an aluminium cladding.

It will be seen from the figure that even if the gas velocity exceeds 40ft per second, the uninsulated chimney will be attacked; with the aluminium clad chimney, the gas velocity has to achieve a minimum of 17ft per second, otherwise the steel will be attacked, but with the superclad chimney, the gas velocity can fall below 5ft per second before the gases will condense.

These figures emphasise the fact that gas velocity has a direct bearing on the formation of acid condensate and also shows the effect of the turndown ratio on the boiler firing. On small chimneys such as those used in the example, it is normal to work on a gas velocity of 25ft per second on maximum load; and from this it can be seen that at any gas velocity the uninsulated chimney would be attacked; the aluminium clad chimney would not be attacked when on full load, but if the boiler was turned down to less than two-third loading the chimney would be subject to attack. On the other hand, the superclad chimney could quite easily accept a turndown ratio of 4 : 1 without any deleterious effect.

Figure 2 shows the effect of insulation against height for four types of chimney; the first is uninsulated; the second is aluminium clad; and the third is superclad and the fourth shows the effect of 4in of mineral wool or Perlite insulation. The latter insulation is more commonly used in Multiflue chimneys.

As already stated, it is important to keep the maximum flue gas velocity at all times. But this is not possible if more than one boiler is attached to a common chimney. If, for instance, three boilers are attached to a common chimney, it has to be of a size to carry the gases when all three boilers are on full load. But it could well be that the loading commitments are such that at certain times only one boiler is on load at a 3 : 1 turndown. This means that only one-ninth of the gases are produced; consequently, the flue gas velocity falls and acid condensate attack is virtually certain.

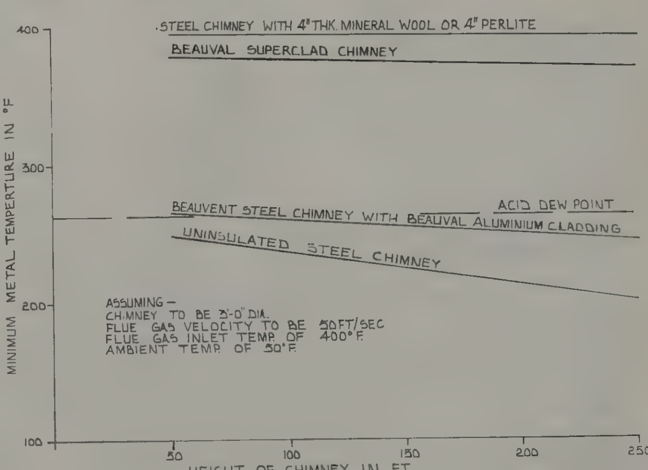
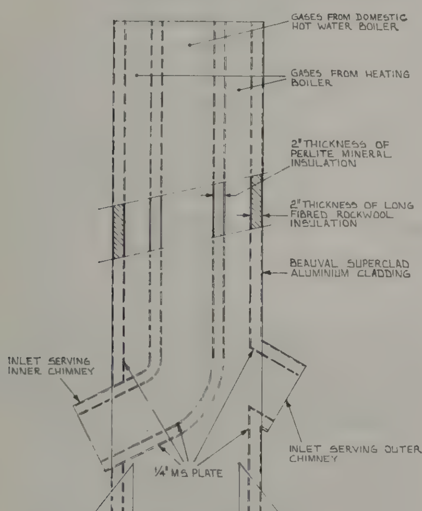


Figure 2

To overcome this problem the Multiflue chimney was developed so that each boiler could have its own "chimney"—but the chimneys were enclosed in a common shell or windshield. This obviated the problem of designing tall, slim chimneys which, structurally, can

give rise to considerable problems and are not desirable aesthetically. There are basically three types of Multiflue chimneys. The first type is where the windshield is divided into two or more segments by fitting splitter plates within the chimney shell. Structural problems can be caused with this type of design unless special precautions are taken, because of the bi-metallic expansion effect caused by the hot and cold segments when one boiler is on load and the other is off load. Such uneven expansion will cause the chimney to deflect. This can be obviated by making the splitter plates in separate segments from the main shell; but the cost of this type of design tends to be fairly high.

The second type of Multiflue chimney is the Concentriflu type which is two chimneys erected one within the other so that one boiler can be connected to the inner chimney and say, two, boilers to the outer annulus; thus, if one boiler is on load only the inner chimney is used; if two boilers are on load the outer annulus is used, and if all three boilers are on load both the inner chimney and the outer annulus are used.



BEAUVENT CONCENTRIFLUE CHIMNEY

Figure 3

Figure 3 is a diagrammatic sketch showing this type of chimney, and Figure 4 shows a concentriflue chimney at the Cardiff College of Art, 110ft high; the diameter of the inner chimney is 15in and the diameter of the outer chimney is 3ft 10in.

The most popular type of multiflue chimney consists of a steel or concrete windshield fitted with internal steel liners, one liner serving each boiler.

The choice of whether steel or concrete windshield is used is normally a matter of capital cost and aesthetics. Up to a height of 200/250ft high a steel windshield is normally less expensive, but above these heights the concrete windshield becomes cheaper.

Steel liners are normally fitted inside steel or concrete windshields and the insulation used is either a loose fill expanded mineral, i.e. Perlite or mineral wool wrapped around the liners.

Figure 4

Figure 5 shows a 125ft high × 4ft diameter multiflue chimney with a steel windshield enclosing three 12in diameter liners, the whole of which was erected in one day, and figure 6 shows a 170ft high concrete windshield at Jersey Water Works, Corbiere, which was fitted with two 3ft 6in diameter liners, provision being made for a third liner, should it be required to extend the boiler plant at a later date. Some concrete windshields have been fitted with molar brick liners but a number of these have failed in use due to the partial or total collapse of the molar liners.

An example of steel liners within a concrete windshield is a 350ft high concrete windshield built at Imperial Paper Mills, Gravesend, into which a 240ft high × 8ft 6in diameter liner, weighing 50 tons, was erected in one day. Figure 7 shows the erection of one of the liner sections.

A modification of the concrete windshield with steel liners design is used in tall rise buildings, such as the new Knightsbridge Barracks; the new Charing Cross Hospital at Fulham and B.P.'s Moorfield House, Moorgate, into which concrete "wells" or shafts have been constructed within the building, steel liners fitted and then the void between the liners and the concrete shell filled with Perlite.

For aesthetic reasons more elaborate types of multiflue chimneys are sometimes constructed but these tend to be more expensive than the conventional types mentioned above.

Figure 5

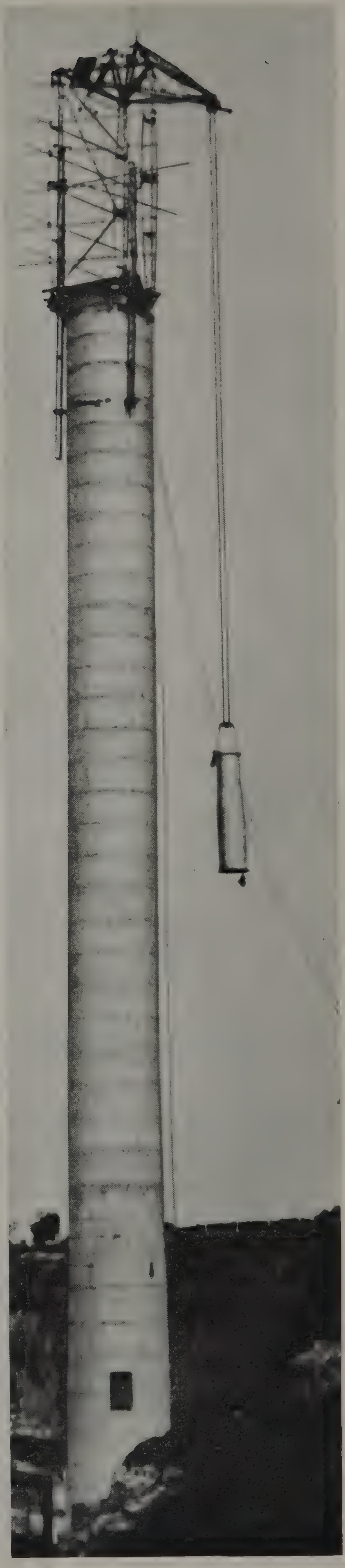


Figure 6

Figure 7

Figure 8

Figure 8 shows three 70ft high mild steel chimneys with aluminium cladding fitted within a concrete structure at the Hendon Police College, and figure 9 shows the 200ft high chimney carried within an open concrete structure at York University.

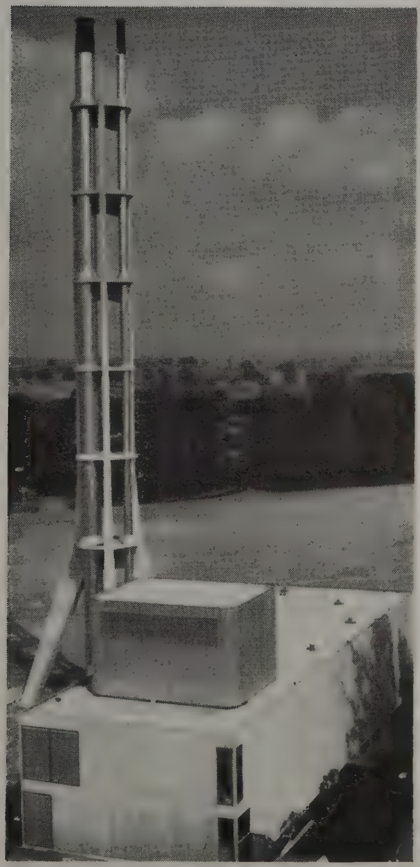


Figure 9

Figure 10 shows a 100ft high open steel structure which carries three superclad steel flues with provision for the fitting of a fourth flue at a later date. This is at Aberdeen University.

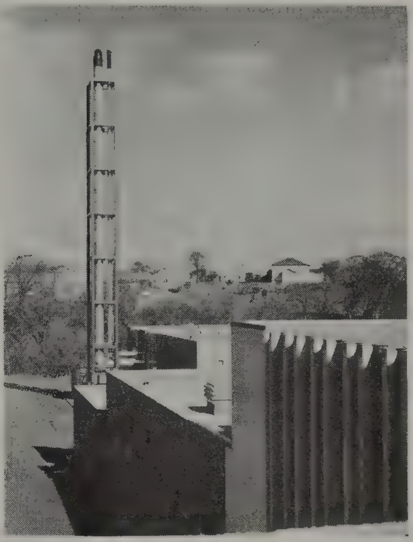


Figure 10

Quite often existing boilers are removed because of their age and new oil fired boilers filled or, alternatively, existing boilers are converted from coal to oil firing. When this happens the existing chimney is quite often grossly oversized and a new chimney has to be provided and the old one demolished. It is often possible to overcome this problem by fitting a new steel insulated liner within the existing brick chimney and figure 11 shows an existing 150ft high × 5ft diameter brick chimney at St. Mary Abbotts Hospital, Kensington, which was fitted with a new 150ft high × 1ft 9in diameter steel liner, insulated with 3in of mineral wool. The existing chimney can of course be used to accommodate a number of steel liners should there be several boilers in the plant. Figure

Figure 11

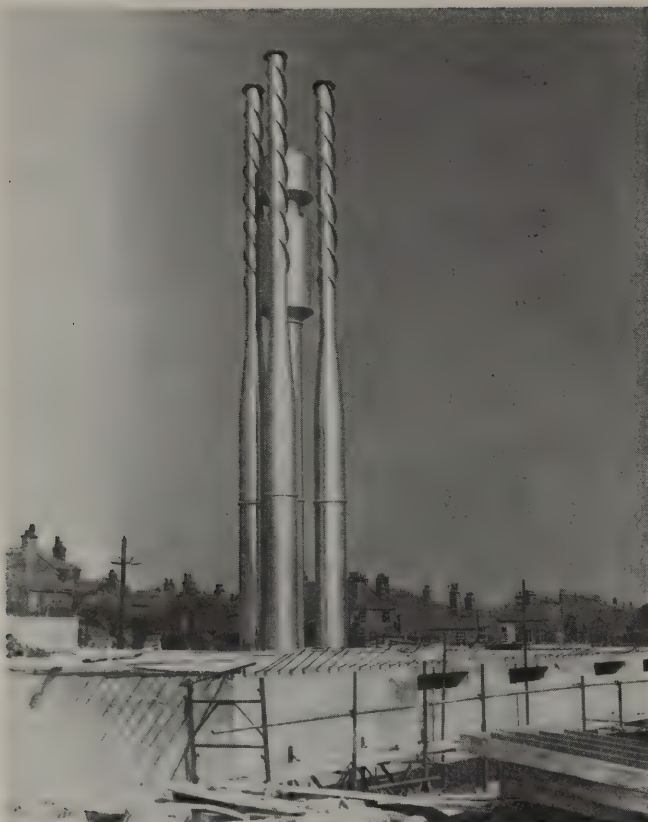


Figure 12

12 shows three 70ft high self-supporting steel chimneys arranged at the points of an equilateral triangle, fitted with helical stabilisers to prevent wind excited oscillations, and supercladding to minimise heat loss, with a 60ft high column at the centre of the triangle supporting two concentric water tanks. This structure was used as an architectural feature and was erected at Macclesfield Telephone Exchange.

When the central boilerhouse at Heathrow Airport was extended in 1970, it was decided to demolish the existing concrete chimney and replace it with a 90ft high complex of three steel chimneys, each of which were insulated with 3in thickness of mineral wool which in turn was protected with a white fibreglass reinforced plastic covering. This complex has been designed so that it can be extended to 120 ft at a later date, should this be required. It is shown in figure 13.

The design of a modern chimney requires considerable technical knowledge as it is essential that it be designed correctly, both operationally and structurally. The author would contend that it is an exercise which should be left to design specialists in what he considers is a highly specialised field.

Figure 13

Queen Mary College, Department of Mechanical Engineering

Colloquium on Exhaust Emission from Motor Vehicles, Control and Testing. This colloquium is being held in order to review fundamentals and assess recent developments in the control and testing of emission from motor vehicles. The following topics will be covered:

(1) Exhaust Emission from internal combustion engines.

(2) The public interest and legislation in the U.S.A. and Europe.

(3) Control and reduction of emissions.

(4) Automation of Exhaust Emission Testing.

The colloquium takes place from 22-23 April 1971. Further enquiries made to Professor M. W. Thring, Department of Mechanical Engineering, Queen Mary College, Mile End Road, London E.1.

National Society for Clean Air

134-137 North Street, Brighton BN1 IRG (Brighton 26313)

The parents of the Society were the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant, and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

National Society For Clean Air

NEWS FROM THE DIVISIONS

SCOTLAND

Air Pollution Project by Pupils of Holyrood Secondary School

For some years now, pupils of Holyrood Secondary School in Glasgow have been carrying out an investigation of air pollution. The investigation started four years ago when a group of pupils formed a science club. The decision to investigate air pollution arose as a result of the introduction of a smoke control order in the Langside Ward of the City, within which the school is situated, and for six months prior to the order coming into force the pupils made daily measurements of sulphur dioxide and smoke levels in the air. In addition, visits were made to many houses in the area in an attempt to get a reaction to the order and also to ascertain whether many changes were being made in the methods by which the houses were heated.

The pupils continued taking daily readings after the order had come into force and in this way it was possible to measure its efficacy by comparing the relative readings. It has been found that, while the smoke level has decreased, the amount of sulphur dioxide remains high. The pupils also take grit measurements monthly and these have shown that there is still a considerable amount of grit in the air. The effects of acid gases, etc. in the air have been observed in the corroded stonework of buildings in the district.

Attempts have been made to correlate the sulphur dioxide and smoke readings to wind direction but as yet the results are not conclusive, mainly due to the fact that it is not possible to obtain an accurate local assessment of wind direction over a 24 hour period. The investigations are continuing at the school and the daily readings are made available to the local authority, to whom they are extremely helpful particularly in view of the school's close proximity to an incinerator owned by the Corporation's Cleansing Department.

There is a close liaison between the school and the Corporation's Smoke Control Department, who were responsible initially in giving guidance to the pupils. However, the pupils have done all the investigating work themselves and they are to be highly commended on the results.

J. J. Feeley,
Hon. Secretary

NORTH EAST

A National Fuel Policy For Clean Air

At the recent annual conference of the National Society for Clean Air held in Southport in October, 1970, a resolution was passed on the closing day relating to the need for a National Fuel Policy. The need for a National Fuel Policy had been discussed earlier in the year at meetings of the North East Divisional Council of the Society and although the resolution itself was carried by an overwhelming majority at the annual conference, it was clear that there remained a certain amount of firm dissentient opinion.

The march of events since the annual conference, particularly in the North East, have surely revealed to even the most obtuse enquirer the increasing need for a firm fuel policy if smoke control is to be pursued successfully in the years to come. Earlier this year it was with profound regret that clean air protagonists learned that the Stockton Gloco Works were to cease production. The Northern Gas Board had, however, been asked by the Government to re-open the Stockton plant in August of this year and by the end of November production was between 800 and 1,000 tons a week. Having regard to the acute shortages of open fire solid smokeless fuel in the country generally and in the North Eastern region in particular one would have thought that this excellent smokeless fuel, Gloco, would have been in great demand, but oddly enough about half of the production has to be stock-piled because of the lack of demand.

Air Pollution is Encouraged

During discussions relating to this unhappy situation the C.U.C. stated that the price of Gloco is now about £8 per ton higher than it was last winter and that because it would be delivered retail at about £20 to £22 a ton, merchants were reluctant to take it into stock as they felt that it was unsaleable at this inflated price. In the North East region many smoke control orders have been suspended until next year, thus enabling occupiers to use coal for domestic purposes. This coal can be acquired at about £14 a ton and it is clear therefore that any householder who wishes positively to pursue a policy of clean air is to be penalised to the extent of £8 per ton of fuel. This absurd state of affairs can to a large extent be attributed to the lack of a firm fuel policy. We have powers to control the price and distribution of eggs, milk, tomatoes and numerous other essential commodities and it is even more urgent that if clean air is to be pursued as a National Policy some form of control on the distribution and price of fuels is necessary.

At present about 170 million tons of coal a year is used nationally of which 23 million tons is used for domestic purposes; coal which will sooner or later have to be substituted by a smokeless fuel. In this connection it is significant that this small proportion of coal used (less than one-seventh of the total) produces more than four-fifths of the smoke pollution at ground level. So long as there continues such a wide disparity in prices a significant proportion of the population, even in the black areas, will choose to burn coal at 14s cwt rather than Gloco at 22s cwt and it seems clear, therefore, that circumstances are such that everything is in favour of the promotion of air pollution. Air pollution is encouraged because of the ready availability and low price of coal and local authorities and individuals who are battling for clean air are unnecessarily handicapped in this way. Some thought should be given to the equalisation of costs not only throughout the country for each particular solid fuel, but also among all solid fuels themselves.

Sulphur in Oil

With coal at 14s cwt and Gloco at 22s cwt both could be sold at about 16s cwt and thus encourage clean air. A similar situation exists in relation to pollution of the air by sulphur dioxide. About one-third of the total SO_2 pollution comes from the industrial and commercial use of fuel oil which includes oil of a high sulphur content. To discourage the emission of sulphur into the atmosphere, particularly in city centres, oil should be taxed in proportion to its sulphur content and in this way encourage the use of low sulphur oils. Exceptions can be made, of course, for large power stations and other similar industrial sources removed from the neighbourhood of city centres or where the emission is discharged at such a height as not to affect ground level concentrations.

In a paper recently prepared by the Warren Spring Laboratory of the Department of Trade and Industry and presented in November 1970 to a conference of local authorities by Mrs. M.-L.P.M. Weatherley, M.A., of the Warren Spring Laboratory, reference was made to the present position of air pollution in this country with particular reference to regional trends. Over a period of 17 years smoke emissions had fallen by 60% over the country as a whole and in Greater London, the most densely populated region in the country, between 1958 and 1969 the smoke concentration in the atmosphere fell by two-thirds—from 150 to 50 ugms/M^3. In the Northern region, which includes Tyneside, however, the picture is much less encouraging. The fall in this region is scarcely one-third, less than half of the decrease in the London area and the significant feature of this region is that the need for air pollution abatement is far greater than in the South.

Wasted Smokeless Fuel

During 1968-69 concentrations of smoke in the Northern region were 108 ugms/M^3 whereas in Greater London the average was 46. Because at the same time the Northern region used 0·69 tons of coal per head of population as against 0·06 tons of coal in Greater London, it is clear that if progress is to be achieved to any satisfactory degree a very substantial reduction in raw coal consumption for domestic purposes must be achieved in the North East in the immediate future. It is interesting to note that more than 11 times as much coal is used per head in the North than in Greater London but that the concentration of smoke pollution is only 2½ times as much. This is obviously because of the larger area of densely populated region in Greater London and, consequently, much more coal per unit area is consumed than elsewhere. Because of this extremely high level of coal consumption and consequent smoke pollution in the Tyneside Region it is all the more strange that one should read in the local press of two million cubic feet of smokeless fuel comprised of coke oven gas being wasted daily by being "flared off" at the Derwenthaugh Coke Works in Dunston. This waste is something of the order of 10,000 therms per day and represents an enormous amount in terms of solid smokeless fuel.

Such confusion created by the inefficiency of fuel distribution surely provides conclusive evidence of the need for a realistic National Fuel Policy as advocated by the North East Division.

Never before in the history of social progress has so much lip service been paid by so many people to such little effect as in smoke control.

L. Mair,
Hon Secretary.

YORKSHIRE

Two meetings of the Yorkshire Divisional Council of the Society have been held since the last report.

The first was on the 17th November, 1970, at the offices of the Public Health Department in Leeds when the business was devoted to a discussion of domestic problems affecting the Division and matters which were of concern to members of the Council. In particular, a lengthy discussion took place about the Alkali &c Works Order, members expressing disquiet that the Alkali Inspectorate was to take over more work from Local Authorities, but in view of the fact that the matter had already been considered by the Association of Municipal Corporations no further action was suggested. Further discussion was held on the subject of fuel shortages and a resolution that local authorities in black areas should be allowed to give grants to any householder who wished to adapt his fireplaces to burn smokeless fuel, on a similar basis to Standard Grants, was negatived by a majority of the members. Finally a resolution was carried that the Divisional Council should ask the National Executive to approach the Ministry with a view to the payment of secondary grants in those smoke control areas which were declared before the 12th August, 1964, but limited to properties fitted with inset open fires.

The second meeting of the Divisional Council was held at the Parkway Hotel, Leeds, 16, on the 26th January, 1971. The greater part of this meeting was taken up by a discussion on shortages of smokeless fuels with members reporting on conditions in their own areas. It appeared that in most areas represented in the Yorkshire Division there was at the moment no serious shortage of smokeless fuel and several members indicated that fuel merchants had adequate stocks to get through the winter unless of course we had very hard weather for the next two or three months. However, the view was expressed that this might well be due to some extent to unauthorized sales of coal in smoke control areas. Several members were of the opinion that smokeless fuels were being priced out of the market as compared

with coal and that there is consequently a very strong temptation for people in smoke control areas to burn coal on economic grounds. When the shortages of smokeless fuels are finally overcome it might not be easy to enforce the use of smokeless fuels only.

In the afternoon an Open meeting of the Yorkshire Division of the Society was held. At this meeting Mr. J. A. Nowill of Shell-Mex and B.P. Ltd. spoke on the contribution the Oil Industry was making in lessening pollution. He said that a major problem was in deciding at what level and at what cost we should slow down our activities as the Law of Diminishing Returns began to apply. He mentioned three areas in which his industry had made especial efforts—combustion of fuel oils, automotive emissions and water.

Fuel oil consumption in the United Kingdom had doubled in the last 10 years but the average sulphur in the black fuel oils had dropped from about 3·6 to 2·6 per cent and for gas oils from 0·9 to about 0·6 per cent; this has been brought about by blending in crudes from new oilfields to the overall benefit. In fact new crudes, new fuels and the decline of domestic coal consumption have caused a drop in SO_2 emission from an estimated 6·5m tons in 1965 to 6·14m tons in 1968 and a probable 5·18m tons in 1985. He mentioned that technical work by oil Companies had improved combustion, developed techniques for the prevention of acid smutting and the detection of stack solids, developed the application of liquefied petroleum gases in the heavy clay refractory and lime burning industries and of course discovered natural gas in the North Sea.

There was great concern about automotive emissions particularly in the United States and there the car industry was pressing for the introduction of non-leaded fuels. The problem here was that substitutes for lead additives would be much more expensive and not as effective and there was in fact no firm evidence that leaded fuels were detrimental to health; in fact the cure might be worse than the ailment. He wondered, perhaps, whether general concern in the United Kingdom was caused by the smoke and filth emitted by badly maintained and over-loaded diesel engines both of which were quite unnecessary. New legislation would, he hoped, see an end to this problem.

Turning to water pollution Mr. Nowill said that water was perhaps in the same position as air was in the 1950s and that public opinion was requiring a thorough clean up of our rivers and seas. The oil industry was playing its part here also and the introduction of soft biodegradable detergents was mentioned. At sea, most oil carriers observe the ‘load on load’ techniques of tank cleaning and new non-toxic dispersants had been developed following the Torrey Canyon episode. Complete international agreement and compliance was always difficult to obtain but gradually the weight of public opinion overcame opposition to everyone's benefit. The meeting concluded by showing two films—“Shadow of Progress” about the world-wide problem of pollution and “Fuel for the 70s” about the uses of L.P.G. in industry.

J. H. Wyatt,
Hon. Secretary

EXHIBITION

“CLEAN AIR AND INDUSTRY”

7-11 February 1972

to be held at

BELLE VUE, MANCHESTER

The Society's first bi-annual exhibition will be an international event.

European firms are being invited to take part in this exhibition aimed primarily at industry and its associated problems in preventing air pollution.

The industrial conurbation of Manchester provides a perfect venue for this exhibition, which, it is expected will prove very attractive to visitors.

23,000 square feet of space is available but due to the good response from our regular exhibitors and advertisers, much of this has already been booked.

Running in conjunction with the exhibition will be a **5 day Conference** at which a specific subject will be discussed each day. Four papers a day will be presented, and registration for the Conference which includes lunch, will be £4 daily. Registration for five days will be £18.

Further details of the exhibition and conference, and the official brochure may be obtained from the N.S.C.A., 134/137 North Street, Brighton. Telephone No. Brighton 26313.

POLLUTION PROBLEMS FROM WASTE INCINERATION AND POSSIBLE REMEDIES

Paper delivered to Scottish Clean Air Conference, 1970.

by W. Short, (N.I.F.E.S.).

Incinerator Design Problems

It is as well for all concerned to accept without reservations, that the incinerator unit, i.e. the furnace, grate and gas cleaning plant are the heart of the unit. Civil and structural engineering-wise, the problems are reasonably conventional.

If the writer appears somewhat sensitive on this matter, perhaps those who disagree will concede that members of a minority profession are occasionally compelled to shout ' wolf ' in order that a sense of proportion is maintained. After all, providing an incinerator unit is properly designed and operated it will do its duty whether the access roads and buildings are first class or inefficient. The reverse does not, however, apply.

For designing combustion appliances satisfactorily, the design engineer should know as much about the fuel (refuse) he is to use as he possibly can i.e. what state will the fuel be in; solid, liquid or gaseous, what are the constituent elements, what is the calorific value, are there any special safety precautions etc?

It can, of course, be argued that it is not even necessary to know anything about the science of fuels in order to use them. This is, in fact, true but it is in the nature of man to desire an understanding of what he is doing. If the old grates, methods and fuels both domestic and industrial were still in common use today, there would be many more occasions in large towns when we would be unable to travel because of smog. Present cleaner air conditions have resulted from a knowledge of fuels and their characteristics.

Calorific Values and Waste Quantity

It is relatively easy to arrive at priorities concerning design criteria. The two most important factors are weight of material and its calorific value. Material density and composition are also important, but to a slightly lesser degree but these two items obviously become of first importance on the mechanical handling side of the plant design.

Now, no designer will size his plant to cope with today's refuse—he must incorporate some reserve unless both the weight and C.V. figures are likely to diminish. Since population is increasing, although the specific yield is remaining fairly stable, a growth factor must be included for refuse weight.

Having said this, why hesitate if all one needs to do is to design a furnace which will accept a given weight and calorific value. The difficulty, however, starts at once over calorific value. When attempting to decide a rational calorific value which will allow for changes in the future there may be opinion expressed, but hard facts about U.K. refuse are very sparse.

Admittedly there is abundant information about the dust, cinder, paper and other classes of material found in refuse. The changes in the proportion of these classes have been noted over a number of years. The calorific value of these classes can vary widely between samples hence any calculations made by attributing a nominal calorific value to each of the classes could give misleading results.

TABLE 1
Refuse Analysis

Content	*1934* %	*1964* %	*1967* %	*1970* %
Fine dust and small cinder	66·7	37·3	22·0	14·4
Large cinder content	8·3	8·5	3·5	3·5
Vegetable and putrescible	6·1	8·9	20·0	24·8
Paper	7·7	31·2	33·5	33·9
Metal	3·3	4·8	6·8	7·2
Rags, bagging and textiles	1·5	1·1	2·5	2·1
Glass (bottles and cullet)	3·2	7·2	8·1	9·0
Unclassified (not included above)	3·2	1·0	3·6	5·0
Density of refuse (cwt/cu. yd)	5·76	3·73	2·62	2·49
Average weight of refuse per house (lb/week)	40·1	34·7	33·5	33·0

Typical Heat Value and Moisture Contents of Refuse Components

Sample	*Moisture Content* %	*Calorific Value (as sampled)*
Fine Dust	9·8	2,770 Btu/lb.
Cinder	5·6	11,780 ,,
Vegetable matter	73·5	2,050 ,,
Paper	9·6	7,400 ,,
Textiles	15·2	5,820 ,,
Wood pieces	10·7	5,810 ,,
Plastics and rubber	5·5	7,990 ,,

Besides knowing values for current refuse or other waste it would also be most useful to examine previous records so that a reliable forecast could be made that if present trends continued, the increases in C.V. would be at the rate of 100 Btu/lb/annum or 10 Btu/lb/annum or even that values were diminishing.

Variations are known to occur but to what extent, seasonal, regional or social changes influence the figures no one can state with authority.

To illustrate these points Table I has been prepared from selected data obtained during various domestic refuse incinerator design projects.

It is interesting to note, that the higher calorific value is mainly incorporated in the carbon content of the dust, cinder and paper.

To some extent, if the furnace is designed without an integral waste heat boiler, the gain when making allowance for oxygen in the refuse is offset by the need for an excess air level sufficient to maintain the furnace temperature below 1,200°C, to prevent undue damage to brickwork or excessive slagging of the residue.

The writer hopes that the importance of calorific values and chemical analysis has been appreciated. Any Authority who would be willing to co-operate in a study to establish for domestic refuse the regional and social structure data, are welcome to contact N.I.F.E.S. Samples can be taken during the quarterly analysis and in no way cause any inconvenience.

Residue

From our knowledge of the material being processed, we can forecast the minimum residual material. The quality of this residue coupled with tonnage and calorific value are probably the main parameters on which the performance of an incinerator can be measured.

The minimum standards which can be reasonably applied to the residue is that it can be tipped without becoming melodrorous, causing water pollution, or feed living organisms. This requirement should also ensure optimum performance in reducing weight and volume. For typical domestic refuse the mean ash and other incombustible content will be a little more than 36%. In round figures there should be a two-thirds reduction in weight. It would be quite difficult to achieve this since there will be some "carbon-in-ash" present but at least we know the order of weight reduction.

All this residue will not, in fact, go to tip because ferrous material will probably be removed magnetically after passng through the furnace.

When discussing the means of assessing residue quality, there is quite a wide band of opinion. Some feel that perhaps too much fuss is made about organic matter. The writer would argue that if reasonably good standards are insisted upon at the commissioning stage, there is some operating margin which will allow for the falling-off in performance which frequently appears in the ensuing years with all plant.

An interesting and useful paper* has been written on incinerator ash criteria. This subject requires a detailed study by all interested parties and should be covered in time by a British Standard Specification.

*"Incineration Ash-Criterias of Performance"' by I. G. Bowen and Dr. L. Brealey.

In respect of organic material determination, this being the residual fraction where the greatest dubiety is felt about means of measurement, the writer would tentatively suggest refluxing samples in a Soxhlet tube using petroleum ether as the solvent followed by bengonol and acetone. This system has the advantage of relative simplicity and is a standard method for organic content determination. Alternatively the "Dusseldorf" method can be used to give a value for the "putrescible" matter in the residue.

Gaseous Residue

The reduction in weight and volume of waste is achieved by discharging the greatest portion in a gaseous form containing a small fraction of gas borne solids.

Taking a domestic refuse as an example typical total products to be handled per pound of refuse are:

Constituent	*lb.*	
CO_2	0·85	Gases 5·51
H_2	0·57	
SO_2	·01	
N_2	3·63	
O_2	0·45	
Incombustible	0·34	Residue 0·34
Totals	**5·7477**	

Nearly all the residue is discharged as ashes and clinker from the furnace, but some of the finer material will pass out as grit and dust in the gases.

Sufficient excess air has been included to keep the furnace temperatures just below 2000°F. It will be seen that processing the refuse results in a six fold increase in mass of material to be handled. Because the greatest weight is in gaseous form, this mass flow basis is not always appreciated. Fortunately this greater part is discharged (via a chimney) well above ground level and with adequate gas cleaning plant need not create a problem.

Noxious Gases From Refuse Incineration

N.I.F.E.S. have recently carried out work on some refuse incinerators in which large proportions of plastic and chlorinated plastic sheet were mixed with normal refuse to simulate the possible future position if the use of these materials becomes more widespread. The unit treated was a fairly small one, but from the temperatures and residence times of combustion products measured, the results are probably quite applicable to large plant. In view of the small concentrations anticipated, samples collected were examined by both gas chromatography and mass spectrometry rather than by chemical analysis methods. Four sets of tests were carried out:

(a) Normal refuse (from blocks of flats) was burned and it was found that CI_2 and HC1 were in such small quantities that they could barely be detected.
(b) Polythene plastic sheet was added to normal refuse to give a plastic content around 25% and the tests were repeated. Again the only gases in detectable quantity were CO_2, N_2, O_2 and water vapour.
The material most widely used in the manufacture of bottles and bags is in fact polythene and the

results so far obtained would therefore indicate that the present method of disposal by incineration of refuse containing plastic as polythene is satisfactory.

(c) Polyvinyl chloride (PVC) plastic was added to normal refuse to give a chlorinated plastic content around 20%, and the tests repeated. A fair concentration of HC1 was detected in the order of 1400 ppm.
It is of interest that NO phosgene or carbonyl chloride ($COC1_2$) was detected, as it is often wrongly assumed that this very toxic gas is present in significant amounts when chlorinated plastics are burnt; in fact Coleman in his paper "The products of Combustion of Chlorinated Plastics" J. App Chem 4 (1954) (7) 379 has shown how extremely low the $COC1_2$ level is even when combustion is carried out with a limited supply of air.
The Alkali Inspectorate recommend that the concentration of HC1 in chimney gases should not exceed 0·2 grains/ft^3 (0·46 gm/m^3 i.e. about 450 ppm and of $C1_2$ the best practicable complete emission is aimed at, but 0·1 grains/ft^3 is tolerated. The maximum allowable concentration in the general atmosphere is usually taken to be 10 ppm and the D.S.E.C. (dangerous for short exposure concentration) is 2000 ppm.

(d) A fourth test used 5% PVC plastic content in the refuse and the effect of a wet washing process studied. It was found the emission to atmosphere of HC1 was about 500-550 ppm in the exit gases and that the washing system removed about one-third of the content.

Other tests made on large incinerators were given in the paper presented to the 1966 Public Works and Municipal Services Congress by Barton and Ostle, and the summary of results reported in that paper is reproduced below:

		Average Reading	*Maximum Reading*
Nitrous Gas	NO & NO_2	100 ppm	200 ppm
Hydrogen Sulphide	H_2S	Nil	Nil
Carbon Dioxide	CO_2	6·0-7·0%	11·5%
Carbon Monoxide	CO	Trace	0·9%
Oxygen	O_2	15%	18%
Hydrogen	H_2	Nil	Nil
Methane	CH_4	Nil	Nil
Sulphur Dioxide	SO_2	80/90ppm	192 ppm
Chlorine	Cl	Trace	2·5 ppm
Hydrocyanic Acid	HCN	Trace	3·0 ppm
Alcohol Vapours	CH_3OH, C_2H_5OH	Nil	Nil
Phosgene	$COC1_2$	Nil	Nil
Arsine	A_sH_3	Nil	Nil
Mercury	HG	Nil	Nil
Ammonia	NH_3	Nil	Nil

Chlorine is undesirable in excess for two reasons; one is its toxicity when discharged into the atmosphere and a second reason is its affinity for hydrogen and iron under certain conditions which can be corrosive to metal.

Possible Future Growth of Plastics etc. in Domestic Refuse

This can be illustrated by the typical figures provided by Brown in his paper given at the Institute of Fuel conference, November 1969. The G.L.C. refuse had an overall plastics content of 0·84% in 1965, 1·30% in 1966 and 1·56% in 1967. Not all of this is plastic material of the PVC type, possibly at most about half. Other figures available suggest that the consumption of PVC is increasing by about 18-20% each year and most of this may be in the "disposable" type of material. The overall usage of all types of plastics has been increasing by about 17% each year, but there is some evidence to suggest that this will slow down, possibly to 13%. Thus it might be predicted that the amount of PVC type plastics may increase from about 0·8% at present to about 2·0% in seven to eight years. From the tests previously referred to, when artificial mixtures containing high PVC contents were used, it would seem that the Alkali Inspectorate recommended maximum concentrations in chimney gases of 450 ppm will not be reached until the PVC content in refuse reaches about 4%. Thus it does not seem that any really difficult emission problems due to PVC will exist for many years to come.

Of course for trade waste incinerators, such as at factories using large amounts of PVC, these troubles may already exist. There may then be a case to consider wet scrubbers or washers, with appropriate treatment of the effluent, or even to introduce neutralising agents such as alkaline dusts or sprays, or ammonia gas, just as has already been shown to be very useful to reduce SO_3 levels in gases from fuels or wastes containing sulphur.

Gas Cleaning

The gases from the furnace of an incinerator will be very hot; they should be at least at 800°C to give satisfactory odour destruction, and even higher temperatures, up to 1000°C should exist in the combustion zone to ensure full combustion of any fine carbon smokes formed by the action of heat on volatile products. These gases must be cooled if they are to be cleaned efficiently, since cyclone arrestors (or electrostatic precipitators for large units) have limiting temperatures.

Multiple cyclones can be constructed to operate at high temperatures, say 700°C, if heat-resisting steels are used, but of course the cost is increased, and more usual materials limit the gas temperatures to around 450°C.

An electrostatic precipitator has the same materials limitation and also the collecting effect is hampered at high temperatures, so that manufacturers prefer entering gases to be at 250-300°C. In this country it seems that the electrostatic precipitator will be used for the larger plants.

The usual method for the fairly large incinerators discussed, comprises spraying water at high pressure through atomising nozzles into the gases, usually in separate cooling towers. Although this is cheaper than adding large volumes of additional cold air, it is by no means cheap if town water is used. The water evaporated into the gases increases their volume and as an electrostatic precipitator is designed for low gas velocities past its plates, this increase in volume automatically increases the size and cost of the precipitator. This is not the end, because the induced draught fan and the chimney diameter also have to be increased in size and cost to deal with the extra gases.

If a boiler plant is installed, then this cools the gases without adding to their mass; the cooling tower and water spray equipment is no longer needed, and the precipitator, induced draught fan and chimney diameter can all be reduced.

The present Memorandum "Grit and Dust" suggests standard levels of emission from boilers and certain furnaces. The author feels that most incinerators can be considered to be solid fuel fired furnaces burning a low grade fuel so that from the heat input to the incinerator (product of fuel weight per hour and calorific value) one can use Figures 3A and 3B of the Memorandum.

It is likely that the Minister will use his powers under Section 2 of the Clean Air Act 1968 to set limits for incinerators as well as other fuel using plant. N.I.F.E.S. have just completed a survey of emissions for the Ministry.

As an interim measure, 0·2 grains/ft^3 (460 mg/m^3) has been suggested as a maximum emission, but this needs care in interpretation.

Consider the three cooling methods described previously:

(a) The use of a boiler plant to generate steam from the heat available. Assuming a well-built plant, there would be no further increase in mass of the products of combustion.

(b) The use of a conditioning tower or scrubber spraying water into the gases to cool them. The mass of the gases is increased due to the weight of the water evaporated. It wll be found that 2·2 lb of cold water will be needed for each lb of refuse burned, and the volume of gases would be increased.

(c) The use of additional air to dilute and cool the products to 500°F.

From exactly the same weight of refuse on the same grate, and presumably producing the same grit burden in the products of combustion it is possible to obtain three different volumes of discharge products to the chimney, in the ratio 1:1·46:4·34. This would, of course, require completely different sizes and designs of electrostatic precipitator or cyclones, induced draught fan, ductwork and chimney, and in particular the power needed for the fan would vary in almost the same ratio.

Now consider the weight of grit and dust emission that could be allowable under various assumed regulations. If the thermal input were used, together with Figure 3A of the Ministry Publication "Grit and Dust", then there would be the same permissible emission for all cases. However, if a target of 0·2 grains/ft^3 were used for plants "where technical and economic difficulties" prevent lower targets being attained, then applying this without any other standardising factor, one could have target emissions under the three types of gas cooling discussed of the same ratio in weight 1:1·46:4·34.

Obviously this would be difficult to justify, since the efficiency of the collector or precipitator would progressively be capable of relaxation. Taking a town refuse incinerator burning 10 tons per hour, if the dust burden leaving the furnace itself were 5·0 grains/ft^3, and evidence suggests this is quite possible for modern mechanised incinerators, the required collecting efficiencies would be respectively (a) 95·6% (b) 94·3% (c) 82·7% and the requirements on the thermal input method would be 96·7% for all cases.

It is interesting to note that if the CO_2% were measured by an Orsat apparatus or any other instrument in which the gas samples were cooled, the result from the plants (a) and (b) *would be exactly the same*, at about 11% CO_2 content. This apparent contradiction is because the dilution of the products of combustion in case (b) is entirely due to water vapour, which would condense in sampling, so that even a specified target emission in grains/ft^3 corrected to a standard CO_2 content would not differentiate between these two cases.

Chimneys and Dispersal of Gases

The Memorandum "Chimney Heights" is a very useful guide to the height that might be recommended for a new chimney. It is based on the sulphur content of the fuel and while as such it may be very suitable for conventional fuels and for many wastes containing sulphur in similar percentages to those of conventional fuels. Even for town refuse present sulphur contents may be only 0·2% and may therefore not be the best yardstick. The chimney height may have to be modified by also taking into account other noxious gases such as HC1 and by considering the likely fall-out pattern of grit and dust over the surrounding district. For wastes containing appreciable proportions of elements such as chlorine, phosphorus, fluorine etc., the Alkali Inspectorate may set special standards. Many formulae exist for calculating the behaviour of plumes of gas from chimneys and the fall out of grit and dust from such a plume. None are perfect and the number of possible corrections that can be applied to deal with every type of atmospheric condition are very great. However, theoretical considerations can be useful when considering a rather unusual new plant providing one does not forget the possible low order of accuracy in some atmospheric conditions such as inversions. The use of a computer allows these laborious multiple calculations to be done in a few hours at reasonable cost and if a wind diagram is available for the area, showing directions and speeds for a typical year, the distribution pattern can be determined for a mile or so around the site, and concentrations of gases at ground level or deposition rates of grit and dust calculated.

From the Alkali Act regulations, maximum acceptable ground level concentrations of various gases such as HC1, SO_2, etc. can be inferred and the theoretical calculations will show whether such levels are likely to be reached. The Act, and many other research papers, suggest that if SO_2 is taken as an example any new chimney should not produce a maximum g.l.c. more than 37-40 p.p.h.m. Again if deposition rates are calculated from theoretical formula, the author suggests that providing the maximum g.l.c. does not exceed 10% of the existing background deposition, known in most towns from published deposit gauge figures, nuisance is not likely.

Very briefly the basic formula is the Sutton equation; maximum g.l.c. in p.p.h.m. is given by:

$$\frac{K\ (\text{lb/hr of pollutant})}{(\text{Wind Speed})\ (\text{Effective height})^2}$$

Where K is a constant.

This effective height consists of two components, the actual height of the chimney plus the height to which the plume of gas rises above the top of the chimney before its upward movement is lost due to cooling and diffusion. This latter figure is largely governed by mass and temperature; other things being equal a hotter plume rises further than a cool one, and alternatively a thick column with greater mass of gases rises further than a thin column of less mass.

The thermal plume can be influenced by several possible alterations:

(a) *Temperature of Gases*

It may be possible by insulation of the flues, fan casings and the stack itself, to increase the temperature of the gases quite considerably, this in turn will give a higher thermal plume and lower ground level concentrations.
Any air infiltration after the plant itself will have a bad effect because it cools the gases and the flues.

(b) *Velocity of Gases*

If the gases leaving the top of the chimney are at very low velocities, then wind effects around the chimney may cause down-draughts dragging volumes of gas down the lee side of the chimney. Exit velocities should be of the order of 25 ft./s. at the lowest likely load of the plant to prevent this. In extreme cases venturi fittings or truncated cones have been used where with proper design and very high gas velocities, improvement has occurred. The design consideration should be for 50 to 60 ft./s. at full load.

(c) *Mass of Gases*

In some Industries, such as Chemicals, gases such as SO_2 or chlorine may be given off in small quantities from the process. If these gases were led to another chimney already carrying a large mass of gas, then the thermal plume effect might give a greater rise to the noxious gases than would occur if they passed into their own small stack. Similarly with a battery of incinerators it is better to combine the gases from all of them into a single stack rather than have individual chimneys.
This single stack is better as a multiple flue one to maintain a high velocity up it when only one unit might be in use.

(d) *Height*

If after considering all the previous items the ground level concentrations are higher than desirable, increasing the height of the stack may be the only solution. As will be seen from the Sutton Equation even a fairly small increase may have a pronounced effect. Unfortunately such increases are usually very expensive, as the extra weight may involve new foundations or supports for the chimney.

Sewage Sludges

Typical (undigested) sludge is taken to be 95 per cent water; 5 per cent solids. The calorific value of the solids varies slightly depending on type of population, but typical values range from 5,000 to 7,000 Btu/lb., in inverse ratio to ash content which may vary from 20 per cent to 45 per cent. At 95 per cent water content (19 lb. of water per lb. dry solids) the heat available by combustion of the solids will only give 300-330 Btu to each 1 lb. of water. As the latent heat of evaporation even at atmospheric temperature is 1,055 Btu, it can be seen that even with a perfect incinerator in which the products of combustion could be cooled right down to atmospheric temperature by evaporating water from the sludge, there is no hope of a sustained reaction using only the heat from the calorific value of the sludge.

If other waste such as domestic refuse is used to provide auxiliary heat, then this heat may well be considered available at no cost. However there is a limit to the amount of sludge than can be burned, dependent on two possible assumptions:

(a) Waste gases from the incinerator can be used to pre-dry the sludge. A limiting temperature is around 290°C to precipitator and stack for corrosion reasons. However a major problem is that pre-drying at relatively low temperature drives off volatile odorous compounds from the sludge which are not decomposed by high temperature. Although this system can allow a greater proportion of sewage sludge to be burned, it is doubtful whether the chimney gases would be acceptable as even after dilution of the gas plume, residents downwind may find the odours objectionable.

(b) The sludge is sprayed into the incinerator combustion chamber or mixed with other refuse in limited amounts so that the combustion chamber temperature is maintained high enough for odour destruction and combustion of the dried solid particles. The temperature must be kept safely above 680°C and the residence time of the gases must be at least two seconds (or a higher temperature for a shorter time) and this may mean the design of an "over-sized" combustion chamber above the refuse grate to give the necessary residence time.

Apart from the combined incineration of sludges and domestic refuse, which the author feels is the best solution where possible and where the relative proportions are suitable, special sewage sludge incinerators exist, usually of the single or multiple-hearth type, although fluidized-bed designs can also be used. If it is uneconomic to burn extra fuel, such as oil, to supply the drying heat requirements, the other possibility is to dewater the sludges mechanically until the calorific value of the solids is sufficient to evaporate the remaining water and give a self-sustaining incineration system. For sewage sludges, the moisture content must be reduced below 60-65 per cent.

The quality of the water removed can often represent a very serious disposal problem. The B.O.D. content can be very high, to some extent due to the finely divided solids that escape the de-watering process. If the sewage treatment works is already well-loaded, the return of this impure water can cause serious operating difficulties.

Alternatively even if the process is not affected adversely the works may be so heavily loaded that the effluent rises above Royal Commission Standards. (Some works are known where, due to local circumstances, standards well below R.C. levels are demanded.)

A de-watering process may then have to be considered as a package including filtrate treatment to reduce B.O.D. and solids levels to values either acceptable for recycling to the works or even to R.C. standards for direct discharge.

Special Wastes

Although much of what has been said on domestic refuse and sewage sludge is applicable to any solid or slurry type of waste, one or two special problems can be mentioned.

Certain chemical industries produce relatively small quantities of highly toxic residues, such as fluorocarbons or organic tars. For example, one fluorocarbon is lethal in concentrations of 50 p.p.h.m. in six-hour exposures. In such cases the design must concentrate on virtually complete destruction into simple gases and expensive automatic controls must be fitted to ensure that the waste is only fed when incineration conditions are completely satisfactory.

A typical unit for gaseous and low-boiling point wastes such as fluorocarbons would use a main fuel such as a light oil or gas in a suitable burner and the vaporized wastes fed with an inert gas such as nitrogen to pressurize the feed lines. The quantity of waste vapour is small compared to the main fuel and combustion takes place in the combustion chamber with a temperature around 1100°C. Combustion products are passed through a packed scrubbing tower and the acid containing water is passed to neutralizing pits where lime slurry is added to neutralize the hydrofluoric acid. The spent slurry is then disposed of by burial. The products after the scrubber are diluted many times by air and then discharged up a tall stack.

With wastes of the organic tar type that can be toxic by skin contact, the tars can be dissolved in a suitable inflammable liquid such as alcohol and the solution fired through an oil burner into a refractory furnace designed to give good turbulent gas mixing, a high temperature of at least 1000°C and as long a residence time at high temperature as possible. When the furnace lining has to be renewed, solvent alone is burned for several days to decontaminate the refractory. Protective clothing is worn by all operatives.

Cans containing paint residues or traces of solvents or simple tars again require special treatment if the residues etc. are to be destroyed by incineration. Usually an incinerator furnace is pre-heated by an oil burner, and when at high temperature the cans can be loaded on a special refractory-topped trolley. A similar unit can be used to destroy mixtures of flammable and aqueous sludges by having a shallow sludge hearth onto which the sludges can be sprayed, again after pre-heating. An after burning chamber may be necessary, with its own burner to ensure an adequate temperature is maintained.

Rubber waste, tyres, etc. can be burned on a cyclone-type furnace in which the waste is fed into a cylindrical refractory chamber and air added through tangential jets to encourage a high-speed swirling pattern to ensure full mixing of the volatile gases liberated from the waste and the combustion air.

Where small quantities of waste have to be burned, even with calorific values, an after-burner system is usually essential since the intermittent operation and batch feeding can cause large temperature savings of material on the grate and of the gases in the primary combustion chamber.

Reader Enquiry Service No. **716**

SPECIAL WASTE PROBLEMS

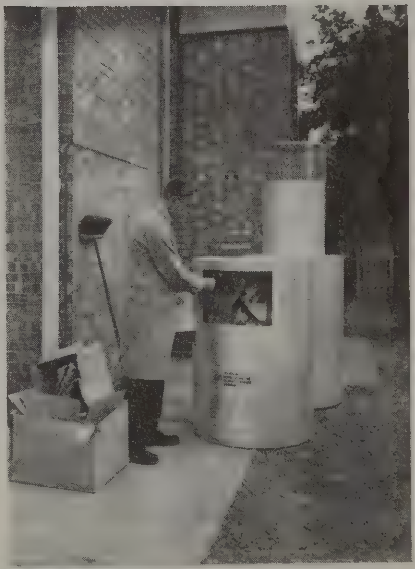
Commercial Waste

Industrial, commercial, institutional, recreational . . . in virtually every category within each of these broad areas of modern working and living, there is a vital need for a dependable clean and effective method of rubbish disposal.

Many companies hold the view that rubbish disposal equipment is non profit making, but it can be dramatically demonstrated that the purchase of an incinerator can show a company considerable savings in overhead costs and as everyone knows, these are 'hidden' costs. The collection, clearance and disposal of rubbish in any premises—particularly large ones—can consume thousands of man hours per year. The rubbish has to be collected from where it originates, carted to a dumping area, from there it has to be loaded on to lorries and transported away, all of which costs money, money, money. Further, rubbish is most unsightly—it is also unhygiencic and it uses up valuable space. An incinerator—one of modern design, will not only clean up any premises it will substantially reduce overhead costs. Rubbish is collected from where it is generated and put into the incinerator and there it is destructed to light sterile ash, without any smoke or smell—it's all so simple and convenient.

Take a look at the pictures. A typical yard where precious space is filled with dirty insanitary rubbish, eternally "waiting for collection". Now look at the other picture. The same yard, the SAME DAY a smokeless industrial incinerator was delivered. A short job daily now WINS this precious space for productive use.

Incinerators, of the very latest triple chamber design, are justifiably called



the "impossible improvement" because they offer an incineration capability previously believed out of the question for such a low price, this equipment is fast becoming the practical, workable reality, largely through application of the Hydro-X process of combustion which, of course, burns without smoke, smell or fly-ash.

Four models of this particular range are available and their capacities are 1·94 cu. ft., 6·35 cu. ft., 18·7 cu. ft., 35·3 cu. ft., and the respective prices are £30, £65, £147, £290.

Reader Enquiry Service No. **717**

Solid Waste of High Calorific Value

To help industry deal with the ever increasing problem of solid waste disposal the Rotoflame Incinerator has been developed which disposes of high calorific value waste materials.

Rotoflame units are individually designed to meet the specialised requirements of various industries. They give clean and complete combustion without smoke.

Based on a new cyclonic air flow design the incinerator produces high intensity combustion of large or small waste material without having to force combustion air through the material.

The design incorporates high furnace loading resulting in a relatively small incinerator, easy to control and ideally suitable for high calorific value waste, suitable for batch or continuous feeding.

The basic incinerator design consists of primary and secondary combustion chambers, each lined with high quality plastic refractory materials backed by high temperature castable insulated materials, and supported by a conical reducing throat, allowing gases to pass into a secondary chamber. The oil or gas burner would normally be incorporated for start-up or continuous support as necessary.

The incinerator can be fired either horizontally or vertically depending upon the nature of solid waste material. Wherever possible, the waste is air conveyed and thus held in suspension long enough to permit rapid and complete combustion. Combustion products can be discharged to atmosphere via an integral stack, or when practical they could be utilised for waste heat recovery.

The Rotoflame Incinerator can be used for disposing of any high value solid wastes, a few examples of which are pyrethrum mare, sunflower, cocoa, rice and dried coffee husks, expanded polystyrene, butadiene off-cuts and sawdust.

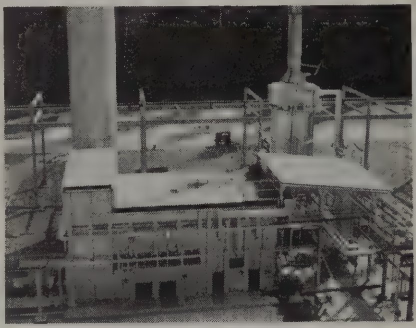
Each Rotoflame Incinerator unit is designed to the individual customer's requirements.

These are some of the features of Rotoflame Incinerators: Incinerators can be mounted horizontally or vertically. Any outlet temperature from 150°F to 3300°F. Incinerators can be designed for a gross heat liberation of 3 m. Btu/hr to 300 m. Btu/hr. Can be designed to burn liquid, solid or gaseous wastes or a combination of any. Low residual heat allows easy accommodation of rapid changes in process conditions.

Reader Enquiry Service No. **718**

Chemical Waste

Two incinerator units have recently been installed at BP Chemicals (U.K.) Limited Grangemouth factory. One disposes of the residual tar fraction from the new phenol plant and the other burns general factory waste. Fly ash and airborne solids are in each case arrested by water screen; to precipitate soluble acids in the tar-burning unit, a multi-spray gas washer is employed in addition.



View of the new incinerator for disposing of residual tar fraction from the BP phenol plant at Grangemouth

The residual tar from the phenol plant is first blended with more fluid residues in a storage tank to the required viscosity for good combustion and then passed to the incinerator. The blend is atomised under air pressure and ignited by a Laidlaw Drew gas burner. Ignition takes place in a patented stainless steel tray burner and windbox assembly, which provides additional combustion air. There are two burner stations each rated to pass up to 1500 lbs. per hour.

Phenol plant incinerator showing side view of main combustion chamber with secondary air supplies (left), and water screen chamber with multiple water inlets (right)

View of general factory waste incinerator at Grangemouth

The main furnace is of 1800 cubic feet capacity, such that it will accept a minimum firing rate of 10,000 B.t.u. per cubic foot per hour, and a maximum firing rate of 30,000 B.t.u. per cubic foot per hour. On leaving the main furnace, the gases enter a large secondary chamber, in which the combustion process is completed. By turning the gas stream through 90° to pass through a constant screen of water drops, solid particles are separated from the flue gases centrifugally, and drop down into a central water trough. The trough runs along the axis of the incinerator, from the combustion chamber through the secondary chamber and thence to a large settlement pit. To precipitate soluble acids the gas stream is further processed through a multi-spray washer of overhead sprinkler design. This unit separates the gas stream into a number of small channels and subjects each to a full cone of water spray. The flue gases are then led via an 8 ft. diameter refractory lined flue to the stack which rises 100 ft. above ground and is of 7 ft. internal diameter.

The water trough within the incinerator is continuously recirculated from the hearth towards the settlement pit. Ash can be removed in this way or via access doors at the side of the main combustion chamber. At the settlement pit, the waste forms as sludge at the lower levels. To remove this, the bulk of water is pumped out by the recirculation units, and a "sludge-gulper" syphons off the residue.

The incinerator is designed to work continuously. To facilitate periodic running maintenance, the roof is of suspended design, allowing sections of refractory lining to be withdrawn and replaced. However, to minimise maintenance, best quality Scottish refractory bricks are used, backed by an outer walling of insulating bricks, set

Side view of general factory waste incinerator showing from right to left: access door, ducted secondary air supplies, secondary burners, connection to base of chimney

in a steel outer casing. Controls are of the failsafe type; feed is arrested in the event of flame failure of the pilot burners or fans. Thermostatic control prevents insufficient or over-heating, and this is remotely monitored at the main Phenol plant control room.

General Factory Waste

The other incinerator at Grangemouth is designed to burn two types of material, namely carbonaceous sludge and solid matter such as packing materials, oily rags, and general factory waste.

The carbonaceous sludge is derived from various drainage separators, chemical vessels and "knock-out" sections within pipe lines, where residues are accumulated. This type of waste is an amalgam of substances many of which cannot be disposed of on the municipal tip. Other means of disposal presented many problems and it was decided that the use of an incinerator gave the best solution.

Like the incinerator in the new Phenol plant, liquid waste is atomised into the incinerator via stainless steel tray burners. The holding tank for liquid waste is adjacent to the incinerator and is fitted with a heater coil to maintain fluidity. The main combustion chamber is partially partitioned to allow solid waste to be fed via an access door at the front. Thereafter, the design is similar to that of the Phenol plant except that a secondary overhead water sprinkler system is not required.

Access doors are provided so that drums containing hydrocarbon waste can be mechanically loaded into the main combustion chamber for periods of up to three hours. An extension of this incinerator will allow automatic loading of solid refuse via a bin-tipping unit serving the proposed new cell. A gap will be provided between the new cell and the existing combustion chamber so that drums can be inserted; heat from the celi for solid wastes will burn out the drums, and heat from the liquid wastes will provide after-burning of the gases produced both by the solids and the drums.

Reader Enquiry Service No. **719**

Wood Waste

The furniture and joinery industries are among the largest producers of combustible waste, complicated in many instances by a high proportion of fine bone dry dust.

A London company have satisfactorily solved the problem with a furnace design which incorporates controlled primary and secondary air supplies, and is suitable for both hand and mechanical firing.

The furnace may be coupled to a waterbath for incineration or to a boiler for heat recovery, or both, with standby oil, gas, or coal firing. The company's own bunker fed system is adjustable to give automatic pressure control for steam raising or constant throughput for incineration and will fire any proportion of fine dust.

Where, as is usually the case, the company has overall responsibility for the waste disposal plant, including if necessary the exhaust from the woodworking machines, it is possible to make an integrated calculation of the plant requirements, as follows:—

(a) Air volume required to exhaust machines.

(b) Bunker capacity required to provide adequate buffer storage.

(c) Required extraction rate corresponding to the hours of burning.

(d) Furnace volume to ensure smokeless combustion.

(e) Gas flow to hold the furnace to a satisfactory temperature for reasonable life.

(f) Boiler output and proportions for this type of duty.

(g) Waterbath area for incineration.

(h) Induced draught fan size, speed and power, for heat recovery.

(j) Chimney dia. and height for satisfactory natural draught incineration.

In general the requirements of the U.K. market for this type of equipment calls for a range of furnace capacities from 1 cwt. to 30 cwts. per hour. Below this level, whilst the technical possibilities are the same, the economies have to be studied in relation to other methods of disposal.

One question which arises is the production of warm air for heating, by direct transmission. The problems are the extremely high temperature of the furnace gases, the need to maintain an effective seal between the air and the gases, and the protection of the plant against overload or failure of the power supply when on full load. A boiler with its safety valve has a far greater heat sink capacity than a heat exchanger, and can distribute steam over a wider area without the power consumption that would arise with fan-air distribution.

As regards the economics of waste disposal by incineration, the timber consuming industries are well placed to take advantage of the integrated plant in which it is possible to completely eliminate labour from the firing of the machine waste. This leaves only the offcuts to be hand fired and even this can be hogged if conditions are favourable.

In the writer's opinion the indiscriminate use of afterburners should be avoided, as most types of waste can be consumed smokelessly provided that the furnace temperature and the primary and secondary air proportions are correct.

The materials which do require special treatment are the expanded plastics and similar upholstery paddings. These are capable of extremely rapid ignition and the near instantaneous creation of a large gas volume to the exclusion of air within the furnace. In such circumstances the use of an afterburner is justifiable, but it should be set to handle as much excess air as possible, since shortage of air is the real nature of the problem.

Reader Enquiry Service No. **7110**

Solvent Effluent Vapours

The eventual nation-wide acceptance of the Clean Air Act will present industry with a major effluent treatment problem. Control of organic solvent emissions from operations such as paint drying and stoving, printing, lithographing, curing and polymerizing is already mandatory in many urban areas.

This is a problem which can be considered in many ways according to the degree of control which is being imposed by law. Firstly, a careful study is necessary to see if it is possible to control or modify the production process so that solvent fumes are eliminated or reduced to an acceptable level. Secondly, investigation of the raw materials used in the production process will show if it is possible to reduce the quantity of solvent matter to a minimum, so reducing the solvent fume concentration. Thirdly, the installation of a direct flame fume combustion unit to act as an incinerator for a solvent.

A specifically designed direct fired fume incinerator will meet the most stringent air pollution regulations. This type of air pollution control equipment requires very little maintenance and loses nothing in operating efficiency. In addition, direct-fired fume incinerators will destroy most organic particles as well as organic solvent fumes and the discharge to atmosphere from the units is odour free.

While these opening paragraphs extol the advantages of direct fired fume incineration a note of warning is appropriate against considering it as a 'jack of all trades'. In fact, with certain degreasing solvents such as Trichlorethylene, Perchlorethylene, or other Halogenated organic compounds the reaction with a direct flame will create a poisonous gas.

If the installation of equipment of this nature is considered as an important engineering project it may be possible to achieve a certain economic advantage by extending the plant to use the waste heat which is available from an incinerator to supply process heating requirements in the works. As a general rule, with small fume incinerators where the efficient volume is less than 5000 scfn heat exchange equipment is not economical. However, on large units, the use of heat exchangers can reduce operating costs, and the investment in plant can be rapidly amortized.

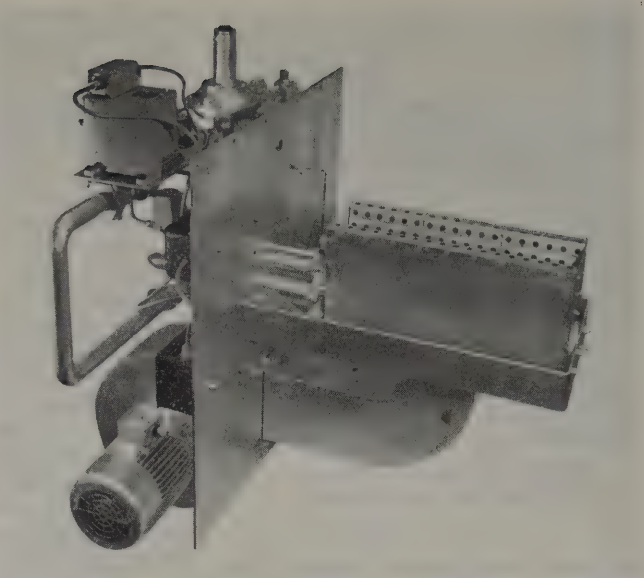
Alternatively, the increase in exhaust gas temperatures will raise the gas velocity considerably and may allow a drastic reduction in overall chimney height.

Fume Elimination Process

The principle of operation is to pass the organic pollutants through a dwell or combustion chamber where they are raised to self-ignition temperature by contact with a direct flame so that all pollutants are oxidized to an innocuous carbon dioxide and water.

The temperature to which process effluent gases must be raised so that the combustion reaction will produce an exhaust gas of sufficient purity to meet specific Clean Air regulations will vary depending on:

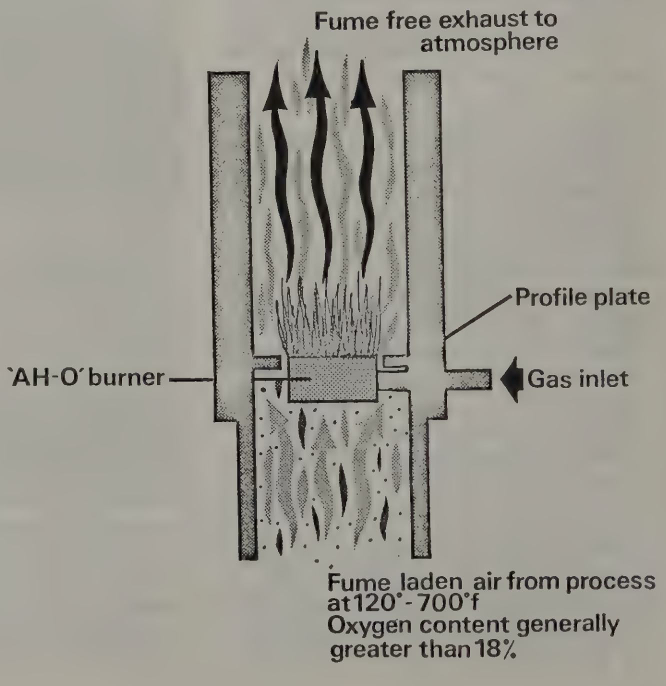
1. The type of pollutant in the effluent.
2. The percentage of exhaust pollutant allowed.
3. Efficient mixing of effluent and flame in combustion.



AH Type Burner Unit

In general, exhaust gas discharge temperatures of 1200-1400°F are sufficient to reduce pollution in effluent by 85-95 per cent. However, in a few instances it may be necessary to go as high as 1500°F in order to produce a sufficiently pure exhaust gas.

The current practice of ventilating direct-fired ovens dilutes the flammable solvent vapours given off in the process, so that there is less than 2 per cent combustible product in the effluent. In practice, it is often less than 1 per cent. This low percentage of combustible material is not sufficient to produce a significant change in the heat needed to raise the temperature of the effluent to 1200-1500°F direct flame incineration temperature.



When the oxygen content of the effluent is high it is recommended practice to use the effluent as either primary or secondary air for the combustion process. This greatly extends the capacity of the unit and depending on the percentage of oxygen in the re-circulated effluent up to 40 per cent more effluent per lb. of fuel can be processed. An oxygen content of 18 per cent or more is necessary for efficient direct flame fume incineration under these conditions. For this effluent condition a combustion chamber layout as in Figure 2 is recommended.

When effluent is used as 'air' for the combustion of the selected fuel, the temperature of the effluent 'air' should be controlled below 700°F, if fuel gas is used, to prevent cracking. If propane or butane is the fuel selected an effluent 'air' temperature below 650°F is recommended.

As the oxygen content in the effluent drops below 18 per cent it is advisable to use an increasing percentage of fresh air as primary and secondary combustion air. A combustion chamber layout as shown in Figure 3 is recommended in this case.

The following empirical formulae, developed by the author, are useful for calculating the net or gross heat input required for the combustion of a given volume of effluent:

$$\Delta H \text{ Net} = \cfrac{1{\cdot}28Q\ \Delta T}{1 + \cfrac{0{\cdot}0188\,(F)\ \Delta T}{(E + P)}}$$

Where ΔH Net = Heat required in BTU to raise the effluent volume to the selected temperature

Q = Total effluent volume in SCFM at 70°F and 30 in. Hg.

ΔT = Temperature rise in °F

F = Fraction of combustion 'air' taken from effluent

E = Percentage of heat available in fuel gas at discharge temperature

P = Percentage increase heat available due to pre-heat in effluent gases used for combustion 'air' (p = 0 at 60°F)

To calculate gross heat input required (ΔH gross) divide H NET by the following factor:

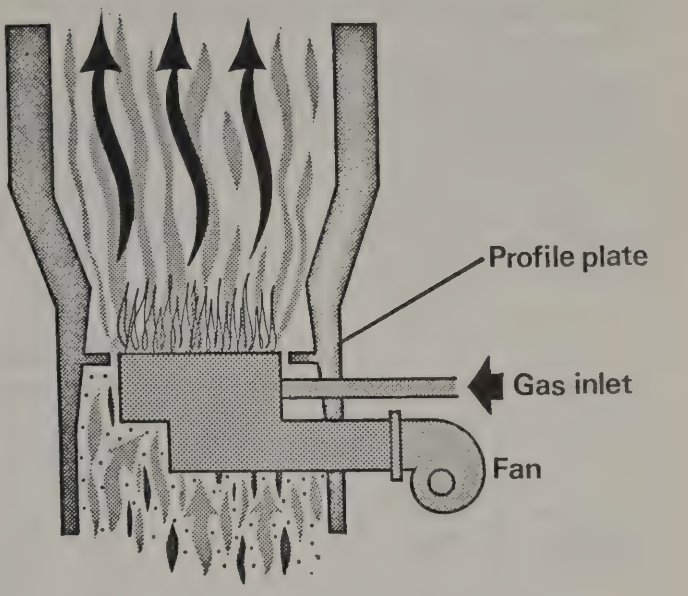
$$\left[\frac{E + (F)P}{100}\right]$$

The values for E and P can be extracted from Table IV.

Burner Types and Sizes

A range of air heat burners are produced which are ideal for direct flame incineration applications due to the high heat release per foot of burner and the long, luminous flame which covers the area of the combustion chamber where the organic pollutants are oxidized. Experience has shown that the effluent should dwell in the combustion chamber for 0·3 to 0·7 seconds and that the velocity of the effluent should not exceed 30 ft/sec. Combining these factors shows that the minimum length for a combustion chamber is 9 ft.

Input rates of 1,600,000 BTU/hr/lineal ft. are feasible when the oxygen content of the discharge effluent is approximately 18 per cent or greater. This generally is the case in most processes using organic solvents in direct-fired process heating systems due to ventilation necessary to meet safety requirements. At this input, flame length will generally range from 40-60 inches for all of the burners listed in the following selection tables. The maximum available pressure drop across burner is recommended.



'RAH' type gas burner for use in fume incineration from recirculating processes where effluent is deficient in oxygen content

An "AH-0" or "TAH-0" type fume burner is used when adequate oxygen is available in effluent (i.e. 18 per cent oxygen content or greater) and a minimum pressure drop across the burner of 0·4 w.c. can be maintained at temperature. Use Table I for selection of burner size required based on required temperature rise and scfm of effluent to be heated. Amount of preheat in effluent is taken into account in selection table.

When calculating from this table, it should be remembered that the design pressure drop at the burner is determined by effluent flow rate and the 'free area' defined by the burner configuration and profile surrounding the burner. It is desirable to use the highest "Δ P" across the burner as this forces more effluent through the burner and increases oxidation rate due to increased turbulence. While pollution control may be obtained at temperatures below 1400°F experience indicates that systems should be designed to operate at that discharge temperature.

Calculation Example:

Effluent at 10,000 scfm and 300°F.
Discharge temperature 1400°F.

$$\text{Burner size} = \frac{10{,}000}{1120} = 8{\cdot}94 = 9 \text{ ft. of burner}$$

Open area around burner at 0·7 in w.c. ΔP
= 31 sq. in. × 9 ft.
= 279 sq. in. = 1·94 sq. ft.

The "AH-0" or "TAH-0" burners should be installed as shown in Figure 4. It is very important that the burner is centrally installed as correct combustion depends on a consistent pressure drop across the burner.

If "RAH" or "TAH-R" type burners are used with partial primary air due to the low oxygen content of the effluent (between 14-18 per cent) the burner size should be selected from Table II. Profiling in the combustion

chamber is used to improve the mixing of effluent in the flame. An effluent flow of 1500 f.p.m. past the burner is recommended.

When the oxygen content of the effluent falls below 14 per cent burner selection should be taken from Table III. For temperatures beyond those shown, interpolate or extrapolate as required.

The free area as shown in each of the tables is the uniform area defined by the profile plate and the burner configuration.

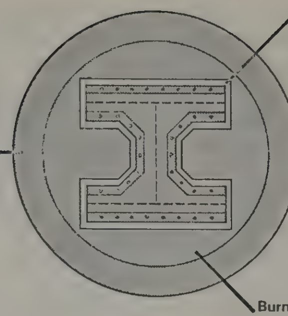


TABLE 1
Based on 12″ length of "AH-O" or "TAH-O" Burner operating at 1,600,000 Btu/hr. with △P of 0·4 w.c. across burner.

Temp. Rise	Lbs./hr. Effluent	SCFM Effluent at 70°F.	CFM-Effluent at Inlet Temp.	CFM Effluent at 1400°F.	Free Area (sq. ft.) around Burner for 0·4″ w.c. △P	Cross-sectional area of combustion chamber for 30 ft./sec. velocity (sq. ft.)
100–1400	4250	944	1000	3310	·46	1·85
200–1400	4640	1025	1270	3500	·55	1·95
300–1400	5060	1120	1610	3820	·65	2·1
400–1400	5570	1235	2000	4100	·79	2·3
500–1400	6200	1365	2470	4460	·94	2·5
600–1400	6950	1540	3080	4900	1·17	2·8
700–1400	7950	1760	3850	5450	1·37	3·0

TABLE 2
Based on 12″ length of "RAH" or "TAH-R" Burner operating at 1,600,000 Btu/hr./ft. and using 73% primary air (from outside duct) with air manifold pressure set at 0·4″ w.c.

Temp. Rise	lb./hr. Effluent	SCFM Effluent at 70°F.	CFM-Effluent at Inlet Temp.	CFM (incl. Flue Products) at 1400°F.	Free Area (sq. ft.) 1500 FPM* at Burner	Cross-sectional area of combustion chamber for 30 ft./sec. velocity (sq. ft.)
100–1400	3370	748	792	3310	·53	1·85
200–1400	3630	805	1000	3500	·67	1·95
300–1400	3990	888	1275	3820	·85	2·10
400–1400	4380	970	1570	4100	1·05	2·28
500–1400	4860	1080	1960	4460	1·3	2·48
600–1400	5420	1200	2400	4900	1·6	2·82
700–1400	6150	1362	3000	5450	2·0	3·00

*Effluent velocities greater than 1500 FPM are recommended if pressure drop across burner is available. Higher velocities at burner increase turbulence and mixing.

TABLE 3
Based on 12″ length of "RAH" or "TAH-R" Burner operating at 1,600,000 Btu/hr./ft. with all combustion air from outside.

Temp. Rise	Lbs./hr. Effluent	SCFM Effluent at 70°F.	CFM-Effluent at Inlet Temp.	CFM (incl Flue Products) at 1400°F	Free Area (Sq. ft.) 1500 FPM* at Burner	Cross-sectional area of combustion chamber for 30 ft./sec. velocity (sq. ft.)
100–1400	3050	677	715	3310	·48	1·85
200–1400	3200	710	885	3500	·59	1·95
300–1400	3600	800	1145	3820	·76	2·10
400–1400	3970	880	1425	4100	·95	2·30
500–1400	4410	980	1775	4460	1·18	2·50
600–1400	4960	1100	2180	4900	1·45	2·80
700–1400	5670	1260	2760	5450	1·84	3·00

*Effluent velocities greater than 1500 FPM are recommended if pressure drop across burner is available. Higher velocities at burner increase turbulence and mixing.

TABLE 4
% Heat Available Chart relating final discharge temperature and degree of preheat of incoming effluent.

Inlet-Outlet Temp. °F.	% Available Heat (no preheat) E	Add'l Heat available due to preheat p	% Heat available (including preheat of incoming effluent) E+p	Inlet-Outlet Temp. °F.	% Available Heat (no preheat) E	Add'l Heat available due to preheat p	% Heat available (including preheat of incoming effluent) E+p
200–1100	68	2·0	70·6	500–1100	68	8·1	76·1
200–1200	66	2·6	68·6	500–1200	66	8·1	74·1
200–1300	64	2·6	66·6	500–1300	64	8·1	72·1
200–1400	62	2·6	64·6	500–1400	62	8·1	70·1
200–1500	60	2·6	62·6	500–1500	60	8·1	68·1
300–1100	68	4·4	72·4	600–1100	68	10	78
300–1200	66	4·4	70·4	600–1200	66	10	76
300–1300	64	4·4	68·4	600–1300	64	10	74
300–1400	62	4·4	66·4	600–1400	62	10	72
300–1500	60	4·4	64·4	600–1500	60	10	70
400–1100	68	6·2	74·2	700–1100	68	11·8	79·8
400–1200	66	6·2	72·2	700–1200	66	11·8	77·8
400–1300	64	6·2	70·2	700–1300	64	11·8	75·8
400–1400	62	6·2	68·2	700–1400	62	11·8	73·8
400–1500	60	6·2	66·2	700–1500	60	11·8	71·8

Reader Enquiry Service No. **7111**

Incineration and a Cleaner Environment

The drive towards a cleaner environment involves municipal authorities and industry equally in the search for safe and efficient ways to dispose of waste. Pollution is a universal concern, with causes rooted in almost every activity of modern life. Logically, it calls for a unified approach from the organisation engaged in its control.

incinerators of two separate designs can be supplied; a moving grate incinerator for inputs above 3 tph and a rotary cone incinerator for inputs below this figure.

The company's venture into this field to extend its pollution control activities was prompted by the obvious demand for alternative means of refuse disposal resulting from the increasing shortage of tipping space, and growing public opinion against disposal by tipping on land adjacent to urban areas.

General view of the incineration plant supplied to the City of Exeter.

Head Wrightson Process Engineering Limited is able to provide a unique concentration of gas cleaning, effluent and water treatment, composting and incineration expertise. Many of these skills have developed through years of experience in designing and manufacturing iron and steelmaking, nuclear and non-ferrous metallurgical plants. Municipal refuse incineration is however, a relatively new product for the company and

There is no question that the need for incineration plants in the U.K. is very great. Based on the present population, 22 million tons of refuse is generated every year in the U.K. The average density of the refuse is 2 cwt. per cubic yard and 220 million cubic yards of tipping or storage space would be required every year if we were to dump all the rotting unsightly rubbish.

Ground area and health considerations are at a premium and the need for incineration plants is patently obvious. The potential of this business is correspondingly very large. To burn the existing quantity of refuse 122 plants would be required if we assume an average plant size of 500 tons per day. The cost of each of these plants would be approximately £2m.

In 1966 Head Wrightson set out to establish themselves in municipal incineration and formed and association with Josef Martin, Feuerungsbau GmbH of Munich, Germany. This enabled them to build the well proven Martin municipal refuse incineration equipment in the United Kingdom. They were already able to supply a rotary cone incinerator for municipal authorities with small to medium populations.

The Martin Incinerator

This incinerator was developed in Germany to burn low grade fuels, such as industrial wastes and slurries and over 400 installations have been made. In 1959, two Martin stokers were commissioned in Sao Paulo to burn municipal refuse. Since their installation, 57 units have been sold to burn municipal refuse. These 57 units have a total burning capacity of over 19,000 tons per day. This is more than any other stoker in the world.

One of the great features of the Martin stoker is that it consists of only one grate. Along the length of the grate alternate bars are fixed to a common reciprocating beam. The remaining bars are attached to a common stationary supporting structure. The length of the grate is designed in accordance with the type of fuel expected and its calorific value. The capacity of the stoker is determined by the width of the grate. Refuse often contains quite a lot of moisture and regardless of its calorific value will not ignite and burn until it is dried. Common practice by other methods usually involves two or more grates, stage one, the drying zone, stage two the heating and igniting zone, and three the burning zone. The single reverse acting Martin stoker is unique because it simplifies this by drying, igniting and burning in one simultaneous process.

The continuous and high efficiency performance of the Martin stoker in spite of varying throughput enables schemes to be provided for the profitable utilisation within limits of the heat developed.

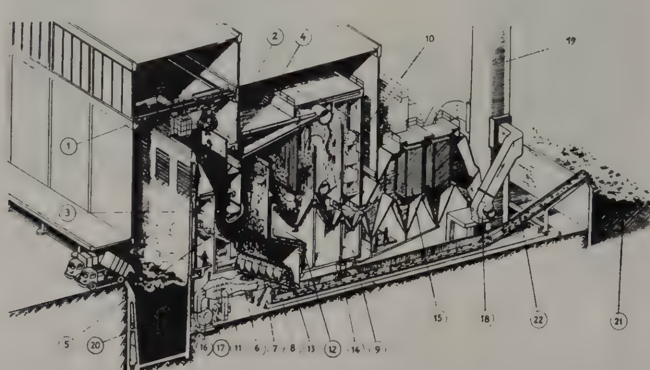
General Description of Refuse Incineration Plant

A typical refuse incineration plant with ancillary steam raising equipment is illustrated below. Refuse vehicles tip their contents into the refuse storage bunker (20). The grab transports the refuse from the storage bunker into the refuse feed hopper (3). The refuse passes by gravity down the feed chute (5). A horizontal hydraulic ram at the bottom of the feed chute feeds the refuse on to the Martin stoker (7). A primary air fan (16) forces combustion air through the hoppers and stoker on to the bed of refuse. The oxygen in the air is, of course, necessary for combustion of the refuse. Normally no auxiliary fuel is required to burn the rubbish except for a short period when starting up.

The clinker produced by the combustion process is quenched in a water bath which is situated below the bottom of the Martin stoker. The cooled clinker is fed on to a rubber belt conveyor (22). A magnetic separator extracts from the conveyor the now sterile tin which is then baled and sold as scrap metal. The clinker is conveyed to a clinker storage hopper (2) and can eventually be sold as road fill.

The hot gases emanating from the stoker pass through a radiant heat boiler (9). The gases which have a temperature of approximately 1000°C impart their heat through the outside metal face of the boiler tubes and into the water which is circulating inside the tubes. The gas temperature is reduced in this way by approximately 300°C at the boiler exit. The water flowing into the boiler tubes is heated and forms steam which can be passed to a steam turbine to generate electricity or alternatively used as process steam and/or hot water.

To extract the dust from the cooled gases, they are drawn through an electrostatic precipitator (15) by an induced draught fan (18). The dust is removed by this highly efficient means and clean gas is passed up the chimney stack (19) to atmosphere. Because the clinker is odourless and no dust is emitted from the plant, it is possible to site a refuse incineration plant in or near to a residential area given the appropriate architectural treatment. The Head Wrightson/Martin 8·3 tons per hour plant supplied to the City of Exeter is an example of how this can be achieved. A larger plant than this is currently being built for the City of Birmingham; its two grates will handle 24 tons per hour. Larger still will be plants to be supplied to Nottingham and Coventry with two and three grates respectively and capacities of 24 and 36 tons per hour.



Rotary Cone Incineration

On a smaller scale, the Head Wrightson rotary cone incinerator combines economy with excellent combustion for refuse inputs from 0·4 to 3 tons per hour. The refuse burns in a slowly rotating cone at temperatures up to 1400°C and combustible material is reduced to a fine ash. A special after-burner reduces gas cleaning requirements by removing up to 90 per cent of the fly-ash. Gases are completely burnt to remove odours and can be used in their hot state to pre-dry refuse before burning.

The rotary cone incinerator provides an ideal means of economic refuse disposal for small-to-medium local authorities. Heat recovery units can also be supplied with this incinerator.

Heat Utilisation

The table below gives an interesting indication of what present day refuse really consists of in scientific terms. This is based on the refuse at the City of Birmingham incinerator being supplied by Head Wrightson. To the ordinary man in the street the table might appear quite difficult to understand but it shows that rubbish is composed of different chemicals some of which are fuels. From this table it can be calculated that when burned the heat contained in one pound of this refuse is 3,000 British Thermal Units (3,000 BTUs).

A significant feature of the Head Wrightson/Martin plants at Coventry and Nottingham will be their unique waste heat utilisation systems. The considerable heat generated by the burning refuse will be used to produce large quantities of steam in special boilers. One-tenth of the steam output will be enough to provide power for almost all the plant's needs—the equivalent of about 25 kw. hours of electricity for every ton of refuse burnt. The remainder will be readily available as process steam for industry and for district heating schemes.

At Nottingham a complex of 6,500 dwellings, two covered shipping centres, a civic centre and various commerial and industrial premises will receive 60 per cent of its heating directly from the incineration plant—an example of the enormous potential in the heat from burning refuse.

Sewage Sludge Disposal

Any all-round approach to the problem of domestic waste disposal must also take account of sewage disposal. Normal sewage treatment methods produce a wet sewage sludge, which traditionally has been spread on waste land around the towns and cities where it was produced. As available land has diminished and the risk of pollution increased, new techniques have become necessary. Head Wrightson have already provided a means of sewage disposal through their composting process. Now a technique for operations on a much larger scale is being developed, sewage sludge will be incinerated along with normal domestic refuse, in a continuous process having first been dried by means of the waste heat from the incinerator.

This new concept will greatly reduce the sewage disposal problem and enable local authorities to deal effectively with all their waste—sewage and domestic refuse—in a single plant.

Ultimate analysis and gross calorific value of typical refuse components

type of refuse	carbon %	sulphur %	hydrogen %	oxygen %	nitrogen %	ash %	water %	percentage present	calorific value BTU/LB
Fine dust 3/8"	5·4	0·1	0·4	2·6		83·0	8·5		865
Cinders 3/8"	3·2		0·1	0·1	0·1	91·0	5·5	14·17	520
Inert Cinder						100·0		1·24	
Vegetables	14·1		2·1	15·4	1·0	2·4	65·0	20·61	2330
Paper (all kinds)	34·0		5·0	40·0	1·0	5·0	15·0	37·83	5390
Rags (all kinds)	36·0		5·0	25·0	4·0	5·0	25·0	3·69	6650
Unclassified debris incl plastics	16·0		2·0	18·0		60·0	4·0	5·53	2375
Metals						100·0		7·39	
Glass						100·0		9·54	

"Air Knows No Frontiers"

INTERNATIONAL NEWS

Meetings of the Executive Committee of the I.U.A.P.P.A in Washington, 4th, 5th and 12th December, 1970

The aim of the Executive Committee of the I.U.A.P.P.A. is to meet every two years. The last meetings were held in Dusseldorf in April 1969.

At the meetings in Washington the Committee decided that the 3rd International Congress should be organised by the V.D.I. in Dusseldorf in the late spring of 1974. The main theme for this Congress would remain clean air, but water pollution, waste disposal, noise abatement, etc., would be included in the Exhibition.

Membership of the I.U.A.P.P.A. has been growing slowly but steadily during the last four years, and the membership on the 12 December was as follows:

Corporate Members:

Asociación Argentina Contra la Contaminación del Aire,
Sarmiento 680,
Buenos Aires, ARGENTINA.
Dr. José A. Rispoli.

Clean Air Society of Australia and New Zealand,
One Parker Close, Beecroft,
N.S.W. 2119, AUSTRALIA.
Dr. G. J. Cleary.

Associação Brasileira de Prevenção à Poluição do Ar,
Departamento de Saúde Ambiental,
Faculdade de Saúde Pública,
Caixa Postal 8099,
São Paulo, BRAZIL.
Mr. Walter Engracia de Oliveira.

National Society for Clean Air,
134-137 North Street,
Brighton, BN1 1RG, ENGLAND.
Rear Admiral P. G. Sharp, Director.

VDI-Kommission Reinhaltung der Luft,
Graf-Recke-Str. 84,
Postfach 1139,
4 Dusseldorf 1, FEDERAL REPUBLIC.
Herr Hans Stephany, President.

Association Pour la Prévention de La Pollution Atmosphérique,
62 Rue de Courcelles,
Paris 8^e, FRANCE.
Professor Agrégé A. Roussel.

Kanto-Shin-Etsu Heat Control Society,
54 Takata-Oimatsu-cho,
Bunkyo-ku, Tokyo, JAPAN.
Professor Kiyoshige Shiozawa.
Mail Address for Prof. Shiozawa,
Waseda University,
School of Science and Engrg.,
4-170, Nishiokubo, Shinjiku-ku,
Tokyo, JAPAN.

Asoc. Mexicana Contra la Contaminacion del Agua y del Aire, A.C.
Toree de Ciencias 5° Piso,
Ciudad Universitaria,
México 20, D.F., MÉXICO.
Ing. Humberto Bravo A.

Schweiz. Vereinigung fur Gesundheitstechnik (SVG)
Postfach 305,
8035 Zurich, SWITZERLAND.
Mr. Walter Hess, President.

SICOM, Stichting Internationaal Contactorgaan Milieubescherming,
Postbus 214,
Delft, THE NETHERLANDS.
Dr. L. A. Clarenburg.

Air Pollution Control Association,
4400 Fifth Avenue,
Pittsburgh, Pa., 15213, U.S.A.
Dr. C. E. Barthel, Jr.

Affiliate Members:

Norsk Forening for Bekjempelse av Luftforurensninger (N.I.F.)
Den Norske Ingeniørforening,
Kronprinsensgate 17,
Oslo 2, NORWAY.
Mr. Erik Thurmann-Nielsen, Chairman.

Asociacion Peruana Para la Prevencion y Control de la Contaminacion del Aire,
Jr. Moquegua 336—Of. 205,
Lima, PERU.
Mr. Aníbal Gastañaga, Presidente.

National Association for Clean Air,
P.O. Box 2276,
Johannesburg, Transvaal, SOUTH AFRICA.
Mr. J. L. Easterbrook, Chairman.

Asociacion Uruguaya Contra la Contaminacion del Aires,
Calle Colonia 1422, P. 6, Ap. 601,
Montevideo, URUGUAY.
Dr. José Olivera Ubios, Presidente.

Yugoslav Commity for Chemical Engineering,
Section of Air Pollution Prevention,
Sarajevo, Omladinsko setaliste bb,
YUGOSLAVIA.
Mr. M. Krstíc.

In future the I.U.A.P.P.A. will have two types of membership, corporate membership and affiliate membership. Any new applicants would normally be made affiliate members to start with, and after review of their status would later be considered for full corporate membership. There would be merit in the formation of continental groups and it was agreed that there would be no objection to Latin-American countries, for example, grouping together and organising events providing that such groupings are not too rigid and formal.

A start has already been made to identify the I.U.A.P.P.A. with other international organisations and it was agreed by all members that relationships with such organisations as W.H.O., should be encouraged as much as possible, and it was urged very strongly that there should be a move by the I.U.A.P.P.A. towards the embracement of matters concerning the environment as a whole.

Maintenance of communications between members will continue by the method of numbered memos already established, but it was hoped that members would incorporate in their journals news of activities in other countries.

At the end of the meetings the President, Dr. Barthel, handed over his office to Herr Stephany of V.D.I., West Germany, and Mr. Arnold Arch handed over the office of Secretary to Herr J. Kramer, also of V.D.I.

ECONOMIC COMMISSION FOR EUROPE

Working Party on Air Pollution Problems

Second session, 25-29 January 1971—Review and Analysis of the Existing Situation and Future Prospects in the Prevention of Air Pollution.

At its first session in February, 1969, the Working Party agreed to include in its programme of work a review and analysis of the existing situation and future prospects in the prevention of air pollution. In accordance with this decision the Executive Secretary invited Governments and co-operating international organizations to submit relevant information to the Secretariat. Information was received from 20 countries and 15 international organizations.

The Extent and Sources of Air Pollution in ECE Countries

The general characteristics of air pollution are determined by the fact that dispersion of air pollutants occurs on two scales: (a) local distribution from factories (point sources) or towns (area sources) controlled by local wind structure, atmospheric stability and topography, (b) large scale distribution of pollutants controlled by the general circulation of the atmosphere and the self-cleaning process within the atmosphere. A good example of this type of pollution is the global spread of radio-active debris from nuclear experiments.

Taking the ECE countries as a whole, air pollution is confined mainly to two types of locality, areas in which there is high concentration of industry and large cities and conurbations.

In the first category air pollution may be more continuous, having serious long term effects on buildings, human health, plant and animal life. In certain large cities however, especially those where industrial plants add to the normal urban pollution, sudden periods of dense " smog " may have serious immediate effects on human health.

In general, therefore, the areas most affected by air pollution in ECE countries coincide with the greatest concentrations of industry. Besides the two rather general categories of areas in which air pollution occurs, there are a number of isolated examples due to a combination of a local concentration of industry, an example being Norway, where fishmeal factories in quite small towns along the coast cause a good deal of pollution in their immediate neighbourhood.

A list, provided by the Council of Europe, of the major sources of air pollution was as follows: steelworks, ore sintering plants, steam generating stations, cement works, sulphuric acid manufacturing plants, ferro-alloy plants, grey iron foundries, domestic refuse incinerators and oil refineries. In a number of smaller or less highly industrialised countries, the most important source of air pollution was reported to be domestic heating.

The last major source of air pollution, and one that is generally considered to be increasing most rapidly in ECE countries, is road transport using internal combustion engines. Virtually every country report placed special emphasis on this, particularly with regard to urban areas. This type of pollution is increasing rapidly in most countries, although in East Europe it is apparently not yet so serious as in large cities of, for example, France, the Federal Republic of Germany and the United Kingdom.

The Pollutants and Their Effects

Pollutants fall into two main categories, gaseous pollutants and solid or particulate pollutants. Most countries reported sulphur dioxide or other sulphur compounds as one of the major pollutants, ashes and soot were the most frequently reported solid pollutants.

One point brought up in the report from the United States was that whereas plants burning solid fuels (coal etc) give rise to both particulate and gaseous pollutants, oil-fired installations produced only the latter. Oil refineries and chemical works were identified as the source of pollutant hydrocarbons, whereas mineral dusts appeared to be principally produced in areas with a large iron and steel industry, or locally near cement or brick works.

An approximate list of the actual damage caused by air pollution is as follows: biological damage to plants and animals, technical damage resulting from: loss of insulating power, corrosion of buildings, corrosion of technical installations, acidification, sooting and technological damage to plant. To this list might be added the social effects of really serious odours produced by certain

types of factories which, though in themselves not harmful to man and animals or plants, may make habitation impossible in the immediate neighbourhood of the source concerned.

Administrative and Organizational Measures for Air Pollution Control

Air pollution may originate in many different sectors of the national economy, and responsibility for its control is therefore seldom vested in a single ministry or other government authority. In most European countries, however, the body responsible for overall monitoring, inspection and often also for supervision of control measures is the Ministry of Health or its equivalent.

Whatever the authority ultimately responsible, most governments have been, or now find themselves, faced with a dual problem in air pollution control. In the first place, there are the existing sources of air pollution, most of which are already identified and the control can be organized. Secondly, there are the sources of pollution about which less is known, often because industrialization has not yet reached the stage at which they become important, or because new processes are resulting in new emissions, on the potential dangers of which little information is available.

The control of pollution from these sources may require a different approach, which may vary less between countries than between types of regions within countries, and types of source.

In the East European countries a good deal of attention has been paid to planning new developments in such a way as to minimize the effects of air pollution as for example by greater segregation of residential from industrial areas, and by the introduction of district heating and the extension of gas and electrical networks, so that points of emissions of noxious substances are minimized. In most countries too, one of the first steps has been to set up an official Commission or equivalent body to concern itself with this whole field.

In most countries with a serious air pollution problem, control is based on a monitoring system, which ideally should cover the whole country. In practice this is scarcely feasible, and monitoring therefore starts in those areas where the problem is most obviously urgent, usually those in which there are large concentrations of industry and/or population. The substance first selected for recording when a monitoring service is set up is normally sulphur dioxide, followed by oxides of nitrogen.

The problem of vehicle exhausts is mentioned in virtually every country's report, although in some instances (Luxembourg, Malta, Norway) it is seen more as a threat for the future than an immediate problem. A distinction appears to be drawn between the visible smoke from heavy vehicles using diesel engines and invisible, but potentially more noxious gases, from petrol-engined vehicles. It is to control the latter that attention is now being paid, the approach in general being the fundamental one of changes in engine and/or the constitution of fuels, with the aim of minimizing the quantities of noxious substances being produced or emitted to the atmosphere.

Besides tackling the problem at the source, some countries plan to mitigate the consequences of exhaust emissions by purely administrative measures such as the further segregation of motor traffic from pedestrian areas, or by the greater use of motorways and by-pass roads.

Legislation (in force and contemplated) Designed to Prevent and Control Air Pollution

The way in which pollution of the atmosphere arises or becomes noticeable appears to follow a basic pattern in most ECE countries and this has been reflected in the development of the relevant legislation.

As an example of legislation based on a single general Law, that from Yugoslavia may be quoted. The basic premise is " that the protection of health of the population and of social and personal property against the harmful effects of air pollution constitutes a matter of common concern to the country as a whole ". The Basic Law for the Protection of Air Against Pollution, of April 1965, is intended to further this concept by " introducing the obligation for socio-political communities, administrative bodies, work organizations and citizens to protect the air against pollution ".

In some countries, while following the same general pattern, legislation has evolved from a different original point of view. Thus in Finland, the earliest law reported was that of 1921 on " good neighbour relations ", which was followed by a decree on exhaust smoke in 1960 and one on public health in 1965.

Although legislation to deal with specific aspects of air pollution has existed in most countries for some years, the general Acts covering the whole field are mostly of recent date.

To sum up this most important aspect of the ECE Government's actions to control air pollution, it appears that legislation has in general moved from the specific, mainly industrial sources, the danger of which became apparent in the first half of the century in many instances, to the enactment of broad-based laws to cover all aspects of pollution. Three categories of sources have been identified, and enacted against, in most countries; industry, space heating, and motor vehicles.

Actual and Possible Costs of Air Pollution Prevention and Control

Information on the economic aspects of air pollution falls under two main headings. Some reports give figures of actual expenditure, usually by Government, on projects specifically intended to prevent or control pollution; others have provided estimates of damage to forests or other resources, or costs to industry or the public, related directly or indirectly to the solution of this general problem.

The order of magnitude of direct expenditure by governments varies widely. Thus, the Belgian report (1968) stated that a sum of 3 million francs was designated for air pollution control under the public health budget for 1968. In Finland, the requirement for 1971 is estimated at the equivalent of US$203,500, with a steady annual increase of 10 to 20 per cent up to 1979.

Few actual figures appear to be available for the costs of air pollution control measures to industry, either in specific instances, or as global estimates for all industries.

The virtual impossibility of estimating indirect costs is mentioned in a number of the reports, and discussed at some length in that from Italy, where the problem includes damage to ancient buildings, works of art, the basic resources of a highly developed tourist industry.

The rather special case of damage to such sectors of the economy as agriculture and forestry was considered in the Austrian report (1968), where a figure of at least 15 million schillings a year was given for the damage recorded in 30,000 ha of forest.

The report from the Council of European Industrial Federations stated that in some cases more than 10 per cent of the total capital cost of a new manufacturing plant might be accounted to air pollution control.

International Aspects of Air Pollution Control

International co-operation in the prevention and control of air pollution takes place at three distinct levels:

(1) on the part of the United Nations and its specialized agencies;
(2) between neighbouring governments or groups of governments, often within the framework of intergovernmental organizations;
(3) by non-governmental organizations.

Several of the subsidiary bodies of the Economic Commission of Europe have for many years been concerned with various aspects of air pollution, including the Coal Committee, the Committee on Gas, and those on Electric Power, Transport, and Housing, Building and Planning. Since the creation of the Working Party on Air Pollution Problems in 1968, this new subsidiary body of the Commission is responsible for implementing the Commission's comprehensive programme of work in the field of air pollution control.

Most of the other United Nations activities have been less directly concerned with air pollution as such, but the work of the World Meteorological Organization (WMO) is of fundamental importance with regard to the dispersion of pollutants in the atmosphere.

The most important intergovernmental organization (in terms of membership) operation in the ECE region is the Organization for Economic Co-operation and Development (OECD) and has concerned itself with research on various aspects of air pollution, centred on the Air Management Research Group.

The Council of Europe has also taken a very considerable interest in air pollution and has set up a Committee of Experts who drafted a Declaration of Principles on Air Pollution Control, which was approved in 1968 by the Committee of Ministers and they have also made a comparative study, in considerable depth, of the legal and other arrangements made by member governments in this field.

As the principal non-governmental body specifically concerned with air pollution, the International Union of Air Pollution Prevention Associations (IUAPPA) is designed to act as a focal point for the effects of national non-governmental bodies in this field. Considerable importance can be attached to their work, since it is often through these bodies that the attention of governments is drawn to specific problems, especially those affecting the general public. A second body also concerned with pollution is Stichting CONCAWE, a study group representing the Western European Oil Companies.

On the technical side, the International Union for Electrical Heat (UIE) has paid attention especially to the ways in which plant such as thermal power stations can be controlled in order to reduce pollution, and has also carried out comparative studies for many other industrial processes.

Possible Future Developments

There is a consensus of opinion that total air pollution will increase considerably over the next few years, even if gains are made in counteracting it in certain sectors.

A number of reports referred to the provision of incentives for industry or private householders to change to systems of heating or fuel combustion less likely to cause pollution.

Although there is no financial element involved, there is no doubt that good publicity will also play an increasing part in helping to attain control of air pollution.

In no field, perhaps, is international co-operation so useful as in the interchange of research results, through meetings and through publications. Here, too, there will certainly be great advances, especially in the newly created atmosphere of genuine and sustained interest in the improvement of the environment by attacking the overall problems of pollution and particularly where urban environments are concerned.

Summary and Analysis of Information Submitted by ECE Countries on Economic Studies Related to Air Pollution

prepared by Dr. J. E. Thompson, United States of America

Austria

Austria reported several completed projects dealing with damage to forest and vegetation. Investigations included sulphur dioxide damage from power plant emissions. A current project is an annual survey of possible crop reduction caused by emissions from power plants.

Belgium

The Belgian Ministry of Public Heath reported that no investigation of economic studies in air pollution had been carried out. Individual industries evaluate the cost of control devices for their own use. The Mining Office evaluated the cost of controlling pollution from cement plants and lime-kilns but the necessary degree of control has not yet been established.

Belgium suggested that future projects should include a study of the cost of reducing sulphur in fuels and the cost of control equipment by industry; and a study of the economic aspects of different effects of air pollution. At international level, the cost of desulphurization of different fuels and the possibilities of using low sulphur fuels should be explored.

Czechoslovakia

Czechoslovakia reports the following completed projects: (a) a study of fly-ash emissions and their influence on the environment; (b) an investigation of emissions from an aluminium plant from a health standpoint; (c) effects of industrial emissions on soil fertility and crop yields; (d) effects of fly-ash, sulphur dioxide, and other industrial emissions on farm animals; (e) a ten-year projection of control needs and cost of control for particulates and sulphur dioxide; (f) an estimate of damage

to the national economy by industrial emissions; and (g) a cost-effectiveness study of methods of obtaining low sulphur fuel for power generation.

Current projects include: (a) regional and local studies of the effects of air pollution on human health, soil, vegetation, and forest stands. These include damage mechanism inquiries, influences on eco-systems, and economic evaluations; (b) an investigation of the effects of industrial pollutants on bee-keeping; (c) assessment of damage caused by corrosion on properties; (d) development of method to evaluate economic activities of model regions; and (e) an epidemiology study of the impact on human health from emissions of chemical plants.

Future plans include: (a) economic studies which would compare alternatives for the spacing of large pollution sources such as power plants; (b) economic studies of various methods of controlling sulphur dioxide; and (c) health research on the effect of sulphur dioxide and other pollutants on children.

Studies of damage to vegetation, materials, and human health should receive special emphasis. Cost-benefit, cost-effectiveness analysis should also be developed for use in overall decision-making. Czechoslovakia suggested that future projects within ECE countries include an economic study of desulphurization of liquid fuels and control of emissions from solid fuels; a study of the economic impact of pollution from atomic power stations; and an investigation of costs necessary for complying with admissible standards of pollutants.

Federal Republic of Germany

The Federal Republic of Germany reported on an investigation of the present status of technology in the desulphurization of fuels.

Finland

Finland has not completed or published any studies on the economic aspects of air pollution. A project is under way concerning the effects of certain industrial activities on the environment and the economics connected with emmission control. Industries included in the project are pulp and paper, paint and varnish, sulphuric acid, fertilizers, cement, iron and steel, and grey iron foundries.

France

France reported that it has not conducted any detailed studies on the economic implications of air pollution; neither on the cost of damage nor the cost of control. Some sectoral studies have been published on the deterioration of zinc roofs and facades in Paris in which annual costs of damage are estimated. "However, in the framework of the Sixth Plan, it is planned to take the economic aspects of air pollution into consideration."

Italy

Italy reported completed projects dealing with the measurement of condensation nuclei formed from automobile exhaust and the atmospheric sulphur dioxide and nitrogen dioxide levels emitted from single sources. A study of sulphur dioxide accumulation in a thermal inversion layer was also published. The effects of air pollution on vegetation, forest, and metal surfaces were investigated. A review was published on studies of air pollution and its effects on man and the economy in general.

Current projects include a study of photochemical transformations from the emissions of a refinery and petro-chemical plant and the resulting harmful effects on vegetation under particular climatic conditions. Another project is designed to investigate the relationship between emissions from a cement plant precipitated in rainfall, and the effects on nearby vegetation. A study of the major technical and economic aspects of air pollution in Italy is under way. This project is designed to establish the annual rate of pollution for the country and determine, for comparison purposes, the cost of damages attributable to air pollution and the cost of control equipment required to reduce or eliminate the pollution.

Attention should be given in future to the question of regulating industrial emissions and to studies on meteorological parameters which play a fundamental role in pollution effects. A study to determine the effects of air pollution on human health, visibility and traffic, paintings and objects of art, tourism and panorama in terms of economic damage is planned. Italy also suggests that ECE countries conduct region-wide studies on corrosion of metals, stones, rubber and synthetic materials, as well as effects on human health.

Sweden

Sweden has completed studies on cost-effectiveness and cost of control for several industries. These include solid waste incineration, the iron and steel industry, grey iron foundries, and the pulp and paper industry. Present projects include a study on corrosion and an investigation into the resistability of forest trees to air pollution.

A research project, on an all-Scandinavian basis, is planned to examine the economic and biological effects of the acidification of rainfall. Another planned project concerns the effects of air and noise pollution on buildings.

Sweden suggested that future emphasis, both in Sweden and among ECE countries, be placed on feasibility studies of the use of economic means (taxes, subsidies, etc.) as a complement to legislation in the control of air pollution.

Turkey

Turkey has completed a study of vegetation damage by sulphur oxides emitted from a copper ore smelting plant. Current projects include: (a) an investigation of methods for monitoring sulphur dioxide and particulate matter from a cost and practical standpoint, and (b) an investigation into the production of a low-cost, semi-coke, smokeless, domestic fuel.

Envisaged for the future are feasibility studies on the use of a number of fuels for domestic heating with research continuing on the production of low-cost, easily distributed fuels. On the international level, it was suggested that attention should be given to the desulphurization of fuels and the removal of pollutants from exhaust gases of internal combustion engines.

United Kingdom

The United Kingdom reported one current project. It is a cost-benefit analysis entitled "Economic and Social Costs of Air Pollution". The purpose of the study is to assess the effects of air pollution on agriculture, health, and general amenities with a view to advising the government on the most fruitful fields for further research. The pollutants of concern are sulphur dioxide and particulate matter.

United States

The United States, using the literature retrieval facilities of its National Air Pollution Control Administration, was able to respond with a large number of published papers and completed projects. Of 639 completed studies reported, 381 were concerned either entirely or in part with "economic and social losses due to air pollution, including damage to forestry, agriculture, materials and structures, and influences on social behaviour". A breakdown of the above categories shows that 54 per cent dealt with damage to vegetation, crops, and forests. Twenty-two per cent concerned investigations of damage to materials and property while 11 per cent were concerned with effects on people in terms of social or economic response. Only 3 per cent reported effects on animals and wildlife while the remainder either did not specify or listed a combination of receptor categories.

Another subject given a great deal of attention was "cost-effectiveness studies relating specific control devices or process changes to emission reduction". The 150 published reports in this field covered control techniques for most industries. Power plants, pulp and paper mills, solid waste incineration and the iron and steel industry were the largest source categories. A number of papers reported on fuel desulphurization techniques. A third major category entitled "Estimates of costs of controlling air pollution on an industry, regional and/or national basis" included economic impact studies of air pollution control. Many of these projects were designed to provide comprehensive economic evaluations of the costs involved in controlling air pollution emissions at various levels both at source and on a regional and/or national basis. Benefit-cost analyses which relate costs of control to benefits derived from improved air quality reflect a fairly recent economic approach to air pollution control. A number of these studies have been completed in an effort to determine both the cost of controlling pollution and the cost of pollution in terms of damage. Results are used for selecting policies and strategies of control. Cost-effectiveness studies of employing alternative abatement strategies or combinations of control techniques have been employed to some extent. These usually involve computer simulation of damages or levels of pollution within a region or airshed using various control schemes on known sources.

Current work in the United States includes a number of "effects" projects designed to investigate air pollution damage to polymers, textile fabrics, electronic components, other materials, and vegetation. Remote sensing techniques are being evaluated for detecting damage to forest stands. A study is under way to determine the social and economic impact of odours on a community. Engineering and cost studies of emission control are being conducted for selected industries and motor vehicles. Various control devices such as electrostatic precipitators, fabric filters, and wet scrubbers are being assessed on a systems basis as are control techniques for different pollutants. Several regional air quality management studies are in progress. These include development of cost-benefit methods and models to evaluate abatement strategies from an economic standpoint. Other projects include desulphurization of fuels, power plant emission studies and an evaluation of possible use of refuse as a low sulphur fuel.

The United States plans to assess the impact on society of the cost of controlling air pollution. The two major pollution categories, mobile and stationary sources, will be studied in depth. The control of emissions from motor vehicles will be of prime importance. Stationary sources will receive further cost and engineering analysis related to processes, fuel combustion and waste disposal. More detailed research is planned on effects (vegetation, materials, animals and people) and associated cost of damage. Human ecology will receive increased attention along with integrated studies of ecosystems. Geo-physical studies will continue with investigations into atmospheric chemistry and chemical transformatons and possible weather and climate modification. An increase in air quality surveillance is planned.

Suggestions for international projects include: (a) a world-wide chain of monitoring devices to assess and evaluate possible long-term ecological changes that may be caused by air pollutants; (b) the creation of a panel of world authorities who could be impartial advisers on problems concerning world-wide environmental quality; (c) the creation of a system to exchange control cost and other air pollution information; (d) economic studies of sulphur oxide control including methods of control to produce sulphur products; and (e) a study to determine, on a cost-benefit basis, the impact on the international community of controlling air pollution.

Yugoslavia

Yugoslavia has published reports dealing with the problems of defining damages due to pollution and problems concerned with restoration of affected areas; government policy and an explanation of basic laws for the prevention of air pollution have been reported. Present work includes a personal interview approach to estimating damages from air pollution.

Yugoslavia plans over the next five years to determine the value of material emitted as waste and to investigate the costs of collecting these emissions and transforming them into useful products. Plans also call for surveys to estimate the cost of air pollution damage to both agriculture and human health. Special attention within Yugoslavia will be given to economic considerations of fuel usage, plant locations, and effects on people, animals, property and vegetation. It was suggested that ECE countries consider (a) development of methodology for economic studies related to air pollution; (b) development of methodology for assessing the economic consequences of the effects of air pollution on people; and (c) unification in the setting of maximum allowable concentrations around settlements.

Summary and Recommendations for ECE Consideration

As mentioned previously, a number of countries offered suggestions for projects which could be undertaken at the international level to fill gaps. Following is a list of all the replies to the questionnaire concerning areas that should receive special emphasis, from the international standpoint, over the next five years.

1. Establishment of a world-wide chain of monitored natural areas to assess and evaluate long-term ecological changes that may be caused by air pollutants.

2. Creation of a panel of world authorities to act as impartial advisers on problems concerning world-wide environmental quality.

3. A determination of how strict air pollution control costs might affect a company's decision to extend its activities abroad rather than at home by, perhaps, some detailed consideration of the factors in the decision-making process.

4. A determination as to how the effective control of air pollution will affect the economic well-being of the international community, including long-term estimates of costs of damage as compared to costs of control.

5. Economic impact studies of air pollution control on industries that trade in a world market.

6. Economic studies of sulphur oxide control. These studies should include use of low sulphur fuels and methods of control that produce sulphur products.

7. Creation of a system to exchange control cost information.

8. Conduct an international study to determine the incidence of damage to vegetation from various air pollutants. This study should be repeated periodically to determine trends or changes in the level of plant damage.

9. Conduct internationally co-ordinated community studies to determine damage to property by corrosion and soiling resulting from various air pollution levels.

10. Development of methodology for conducting economic studies related to air pollution.

11. Development of methodology for determining economic consequences of the effects of air pollution on people.

12. Conduct studies to determine benefits that may be derived from an international unification of maximum allowable concentrations of air pollutants around settlements.

13. Development of methods for prompt, inexpensive, and effective waste gas treatment.

14. Conduct staff training and apply new methods for the detection and determination of air pollution concentrations.

15. Determine costs necessary to maintain acceptable air quality standards.

16. Conduct cost-benefit studies on desulphurization of liquid fuels and control of emissions from solid fuels.

17. Determine the overall impact of pollution from atomic power plants.

18. Development of methods for the removal of sulphur from solid and liquid fuels.

19. Development of methods for the removal of pollutants from the exhaust of internal combustion engines.

20. Conduct studies on the deterioration of metals, stones, rubber and synthetic materials, as well as the effects on people, caused by air pollutants.

21. Conduct cost-effectiveness studies on the use of low sulphur fuel and the desulphurization of different fuels.

22. Evaluate the use of economic means such as taxes or subsidies as a complement to legislation in the control of air pollution.

From the above replies, it appears that the areas of greatest concern are:

1. Problems associated with the desulphurization of fuels.

2. The economic impact of both emissions and control of emissions.

3. The effects of pollution on vegetation, materials, and people.

4. The development of methodology to assess air pollution in economic terms.

Because of the incompleteness of the survey and the diversity of the replies from member countries, no concrete recommendations for ECE action can be offered. The disparity in the replies to the questionnaire suggests a need for some type of clearing-house to collect and dispense information on an international basis.

JAPAN

Recently citizens of Tokyo and other cities in Japan experienced a photochemical smog which occurs when unburnt hydrocarbons and nitrogen oxides contained in car exhaust fumes are subjected to strong sunlight. In Tokyo the smog was intensified by noxious sulphur gases borne on southerly summer winds from the coastal industrial zones of Kawasaki and Yokohama, when the winds were seldom strong enough to clear the still, humid air of the capital.

The first evidence of this deadly smog was a report that a group of children playing in a schoolground found trouble in breathing, and fainted. In the days and weeks that followed thousands of people had to be treated in Tokyo hospitals for painfully smarting eyes and sore throats.

A system of smog warnings were quickly established and on bad days radio and television announcers and touring loudspeaker cars asked people to stay indoors and motorists to leave their cars at home. Children were advised not to play in the open air.

Pollution is now just another aspect of living in Tokyo. Mr. Michitaka Kaino, the director of the Pollution Research Centre, foresees the day when the pedestrian will carry a gas mask as naturally as an umbrella. He has predicted that air pollution will increase 500 times in the next ten years.

Many of Tokyo's justly famous cedars and pines are dying in the city's polluted air. Even the well tended flora in the grounds of the imperial palace are not immune. Animals and birds that have died at Tokyo zoo have been found to have completely blackened lungs. The effects on human health have been under study since 1966. Many cases of bronchial asthma, chronic bronchitis, pulmonary emphysema and other respiratory diseases are thought to be closely related to air pollution.

Air pollution has posed a problem in Tokyo since about 1960 when cheap sulphur-laden Middle East oil replaced coal as the main fuel. Factories burn oil all the year round, office buildings and private homes use

it in winter for heating. Together they pump some 1·7 million tons of noxious gases, mainly sulphur dioxide, into the atmosphere every year. Also must be added the exhaust fumes of some two million cars clogging Tokyo's streets. Atmospheric factors frequently prevent the pollutants in the air from rising and dispersing in the normal way.

The Government have begun to take action. Limits have been set on the discharge of sulphur dioxide by factories, but they are being allowed ten years to conform to the new standards. Office buildings are not affected. In February 1970, the Government approved a recommendation by the transport ministry that the carbon monoxide content of car exhaust fumes should be kept to 4·5 per cent in new cars and 5·5 per cent in old cars.

Water pollution is extremely bad as well. Tokyo Bay, into which many rivers run and round whose shores industrial complexes cluster, is slowly becoming a huge cesspit. Fish, in which the bay used to abound, have been found suffering from cancer and other deformities. Large quantities of cadmium and mercury were discovered in sludge dredged from the sea bed off Yokohama. It was traced to the illegal dumping of industrial waste. Many rivers in Japan are already gravely polluted by cadmium and mercury.

Many other large industrial centres in Japan are also polluted.

U.S.A.

New Federal Regulations for Car Exhausts

Revised regulations, including improved test procedures, that will reduce pollution from new cars in the 1972, 1973 and 1974 model years were announced on 10 November, 1970, by HEW Secretary Elliot L. Richardson.

The regulations, published in the Federal Register, set up tests that will more accurately determine whether new cars meet Federal exhaust emission standards.

Current test procedures, which combine measured data and mathematical estimates, underestimate exhaust emissions from automobiles.

The new regulations are designed to reduce emissions of exhaust hydrocarbons by 80 per cent and of carbon monoxide by 69 per cent as compared to emissions from pre-1968 cars without exhaust pollution controls.

Current standards were intended to achieve these levels. However, 1970 model cars tested under the improved procedure reduced exhaust hydrocarbon emissions only 73 per cent and exhaust carbon monoxide emissions only 62 per cent below the levels of uncontrolled cars.

The improved test procedures take account of typical urban driving patterns, sample actual emissions through the entire test cycle, and relv on more accurate instruments.

The new regulations also eliminate the practice of averaging the test results of all cars in an engine class, which in the past has allowed high-emission vehicles to get by on the performance of their low-emission brothers.

"These changes represent a breakthrough in the measurement of motor vehicle emissions," said John T. Middleton, Commissioner of the National Air Pollution Control Administration, which prepared the new procedures.

"Since the Federal motor vehicle emissions control programme was launched in 1965, we have worked continually to tighten our test procedures with improved techniques and instrumentation," he said.

The new procedures will apply to 1972 and subsequent model-year vehicles since the regulations take effect immediately and prototype testing of these cars normally begins about a year in advance of production.

The new 1972 emission standards, revised to achieve the desired emission reductions under the new test procedures, have been set slightly higher than those proposed in the Federal Register last July in light of additional testing of uncontrolled cars under the new procedures.

The new regulations allow for the use of low-octane and low-lead fuels in test cars in cases where it appears that such fuels would be used widely by the purchasers of the cars.

The regulations also set tighter limits on the evaporative loss of hydrocarbons from gas tanks and carburettors, reducing them from 6 grams to 2 grams per test.

A proposed change in the present method of testing emission control systems for durability has been postponed to permit necessary further study of the differences in results between the existing and proposed procedures.

More stringent exhaust emission standards for 1975 model cars are not being promulgated at this time pending possible establishment of 1975 standards by Congressional action.

These regulations were issued under the Clean Air Act Amendments of 1965, which authorize Federal regulation of the discharge from new motor vehicles of any substances that endanger health or welfare. National standards for controlling exhaust emissions of carbon monoxide and hydrocarbons first went into effect with 1968 model cars.

Airlines Get Warning about Fuel Dumping

Airline officials have been asked by the National Air Pollution Control Administration to stop dumping into the air after takeoff the jet fuel that seeps from the engines into holding tanks during stops.

In a letter to the airlines, NAPCA's Commissioner John T. Middleton said such dumping would be likely to increase air pollution problems in neighbourhoods around airports.

The airlines were asked to report to him by 30 November, 1970, on measures taken to stop any such dumping.

Citing National Airport in Washington, D.C., cast-off jet fuel amounts to an estimated 110 tons a year, and such quantities could have significant effects on the health and welfare of people who live and work near the airport.

Jet aircraft engines burn a fuel like kerosene, which does not vaporize quickly. In Mr. Middleton's letter he said that much of the discarded fuel probably either fell back to the ground or remained as mist in the air.

The fuel seeps from manifolds into holding tanks whenever the engines are turned off. The holding tanks are emptied automatically within the first few minutes after takeoff.

Mr. Middleton said that fuel losses from dumping are estimated to total over 6,700 tons (2 million gallons) a year, nationwide. This, he said, "not only adds to air pollution but is wasteful of essential fuel resources at a time of shortage."

United States airlines are now co-operating voluntarily with Federal officials in an effort to reduce the amount of black smoke emitted by jet engines. Mr. Middleton said that this effort reflected a concern for the environment that made him confident that the airlines would want to stop the seemingly needless pollution that resulted from fuel dumping.

However, on 1 January inspectors parked themselves at the end of runways at Los Angeles International Airport to judge smoke emissions and issue citations to airlines whose jets, in their opinion, are befouling the atmosphere. If the citations are ignored, the resulting fines could be as much as £2,600.

12th Conference Methods in Air Pollution Industrial Hygiene Studies

The sessions for this 12th Conference will be held on the campus of the University of Southern California, Los Angeles, April 6, 7 and 8, 1971.

The purpose of these conferences is to discuss current practices and new methods for source testing. Workshops led by experienced users are designed to provide familiarity with current sampling and analytical techniques.

The course is intended for the technical staff of health departments, air pollution control districts, educational institutions, instrument manufacturers and others concerned with air pollution problems.

Co-sponsors for this 12th session are:

Air Pollution Control Institute,
University of Southern California, Los Angeles.
California Air Resources Board,
California State Department of Public Health.

For further information contact Edward Jeung, Air and Industrial Hygiene Laboratory, California Department of Public Health, 2151 Berkeley Way, Berkeley, California 94704, (415) 843-7900, Extension 595.

38th ANNUAL CONFERENCE

at

FOLKESTONE

2nd-5th November at the Leas Cliff Hall

Our 4 day Conference this year will be opened by Sir Eric Ashby, F.R.S., Chairman of the Royal Commission on Environmental Pollution, and will include papers on:

Sulphur Dioxide—New Report by the Technical Committee

Odours and their Control

Meteorological Aspects of Air Pollution—Global effects and climate

Pollution by Aircraft

Trends in Pollution as indicated by the results of the National Survey

There will be technical and ladies visits, golf and tennis tournaments and social events.

Full membership for the four days is £12. Day membership is £5.

Please apply to the Director for registration forms and further information.

SMOKE CONTROL AREAS

Progress Report

Position at 31 December 1970

(Figures supplied by the Department of the Environment)

(Orders that were to be in operation but have been suspended not included)

	England		Wales		Scotland		Northern Ireland	
Smokeless Zones (Local Acts) in Operation ..	44		—		—		—	
Acres, 3,400								
Premises, 41,060 ..								
Smoke Control Areas in Operation	3,071		7		141		31	
Acres		814,381		1,097		74,873		8,284
Premises		4,206,430		4,979		353,299		15,443
Smoke Control Areas								
Confirmed	42		1		1		2	
Submitted	53		1		4		1	
Grand Totals	**3,210**		**9**		**146**		**34**	

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 31 December 1970

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black areas acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	39,993	31·9	161,692	29·2
Yorkshire & Humberside	186,856	49·6	625,146	53·5
East Midlands	65,320	24·3	193,865	37·9
Greater London	241,192	73·8	2,143,079	81·2
North Western	197,521	49·2	822,310	48·3
West Midlands	85,685	34·4	392,839	37·4
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	824,072	46·5	4,367,628	56·2
Outside black areas ..	152,149		492,857	
Grand Totals	**976,221**		**4,860,485**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue **Smokeless Air** *(Winter 1970) which gave the position up to 30 September 1970. They now show changes and additions up to 31 December 1970.*

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact. Orders that were due to come into operation but have been suspended are not included, as far as they are known.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Tyneside and Wearside
South Shields C.B. (No. 4) Whickham U.D. (No. 9).
Teesside
Hartlepool C.B. (Nos. 16 and 17). Darlington C.B. (No. 5).

Yorkshire

West Riding (North)
Wakefield C.B. (St. John's No. 1). Shipley U.D. (Nos. 10 and 11). Leeds C.B. (No. 80). Saltburn and Marske-by-the-Sea (No. 1/1969).
West Riding (South)
Barnsley C.B. (No. 14/1969). Rotherham C.B. (Broom Valley No. 1). Sheffield C.B. (No. 21).

North Western

South Lancashire and North-east Cheshire
Horwich U.D. (No. 2A). Irlam U.D. (No. 4). Urmston U.D. (No. 9). Stockport C.B. (Brinnington). Atherton U.D. (No. 6). Manchester C.B. (Birchfields).
Central Lancashire
Accrington B. (No. 9).
Merseyside
St. Helens C.B. (No. 7).

Midlands

Derby, Nottingham and Chesterfield
Hucknall U.D. (No. 3). Derby C.B. (No. 18).
West Midlands
Birmingham C.B. (No. 150). Halesowen B. (No. 31).

London

Greater London Boroughs
Kensington and Chelsea (Royal) (St. Charles and Golborne). Bexley L.B. (No. 10). Enfield L.B. (No. 17). Greenwich L.B. (Woolwich Town Centre; St. Nicholas; Little Heath). Hillingdon L.B. (No. 8). Newham L.B. (No. 7). Merton L.B. (No. 16). Harrow L.B. (No. 21). Richmond-upon-Thames L.B. (Twickenham No. 9).

Local Authorities Outside the Black Areas

Hazel Grove and Bramhall U.D. (No. 5). Meriden R.D. (No. 4). Belper R.D. (No. 2). Hale U.D. (No. 3). Castle Ward R.D. (No. 1). Stanley (Durham) U.D. (Dipton No. 1).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Tyneside and Wearside
South Shields C.B. (Nos. 5 and 6).
Teesside
Hartlepool C.B. (No. 20).

Yorkshire

West Riding (North)
Brighouse B. (No. 18). Horbury U.D. (No. 8). Leeds C.B. (No. 86). Wakefield C.B. (Plumpton No. 1 and Central Area No. 3). Stanley U.D. (No. 4).
West Riding (South)
Doncaster C.B. (No. 12). Sheffield C.B. (No. 18). Danton U.D. (No. 14).

North Western

South Lancashire and North-East Cheshire
Blackrod U.D. (No. 2). Kearsley U.D. (No. 4). Westhoughton U.D. (No. 6). Bury C.B. (No. 8).
Central Lancashire
Church U.D. (No. 6). Darwen B. (Nos. 6 and 7). Nelson B. (No. 6). Preston C.B. (No. 22).
Merseyside
Bootle and Litherland (No. 1).

Midlands

Derby, Nottingham and Chesterfield
Mansfield B. (No. 7).
West Midlands
Wolverhampton C.B. (No. 14).

London

Greater London Boroughs
Hounslow L.B. (Heston and Isleworth Nos. 19, 20 and 21). Merton L.B. (No. 17). Barnet L.B. (No. 12). Croydon L.B. (No. 12). Harrow L.B. (No. 23). Richmond L.B. (Twickenham No. 11).
Outer London
Dartford B. (No. 10).

Local Authorities Outside the Black Areas

Darlington R.D. (Newton Aycliffe Nos. 5 and 8, and School Aycliffe No. 9). Hazel Grove and Bramhall U.D. (No. 6). Luton C.B. (No. 8). Skelmersdale and Holland U.D. (Nos. 6 and 7). Todmorden B. (No. 9). Cheshunt U.D. (No. 6).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Teesside
Teesside C.B. (No. 6).

Yorkshire

West Riding (North)
Leeds C.B. (Nos. 87, 88, 89 and 90).
West Riding (South)
Hoyland Nether Hay U.D. (No. 1).

North Western

South Lancashire and North-East Cheshire
Stockport C.B. (Heaviley Hillgate). Farnworth B. (No. 5). Oldham C.B. (Nos. 17, 18, 19). Salford C.B. (No. 21). Radcliffe B. (No. 6). Stalbridge B. (Castle Hall No. 3). Rawtenstall B. (No. 2).
Central Lancashire
Preston C.B. (No. 23). Accrington B. (No. 10). Burnley C.B. (No. 12).
Merseyside
Warrington C.B. (Nos. 14 and 16). Birkenhead C.B. (No. 7). Bebington B. (No. 6).

Midlands

Derby, Nottingham and Chesterfield

Sutton in Ashfield U.D. (No. 1/1970). Dronfield U.D. (No. 6). Chesterfield R.D. (No. 11). Derby C.B. (No. 20). Kirkby in Ashfield U.D. (No. 5). Beeston and Stapleford U.D. (No. 12). Carlton U.D. (No. 8). Blackwell R.D. (No. 1).

West Midlands

Sutton Coldfield B. (No. 19). Market Drayton R.D. (No. 1). Birmingham C.B. (No. 157).

London

Greater London Boroughs

Ealing L.B. (No. 49). Bexley L.B. (No. 11). Richmond upon Thames L.B. (Twickenham No. 10). Kingston upon Thames L.B. (Nos. 18 and 19). Merton L.B. (No. 18). Ealing L.B. (No. 50). Kensington and Chelsea L.B. (North and South Stanley).

Local Authorities Outside the Black Areas

Winsford U.D. (No. 11). Saddleworth U.D. (No. 2). Peterborough C.B. (No. 2). High Wycombe B. (No. 17). Crawley U.D. (Three Bridges). Tamworth B. (No. 5). Southampton C.B. (No. 11). Potters Bar U.D. (No. 4). Reading C.B. (Nos. 15 and 16). Staines U.D. (No. 12). Wortley R.D. (Grenoside).

SCOTLAND
NEW SMOKE CONTROL AREAS IN OPERATION

Glasgow (Yoker).

NEW SMOKE CONTROL AREAS CONFIRMED BUT NOT YET IN OPERATION

Clydebank (Linnvale (No. 8).

NEW SMOKE CONTROL AREAS SUBMITTED BUT NOT YET CONFIRMED

Falkirk (No. 9). Glasgow (Kelvinside). Port Glasgow (No. 6). Renfrew County (New Erskine Community).

NORTHERN IRELAND
NEW SMOKE CONTROL AREAS IN OPERATION

Belfast C.B. (No. 3). Castlereagh R.D. (No. 4). Lurgan B.C. (No. 2).

NEW SMOKE CONTROL AREAS CONFIRMED BUT NOT YET IN OPERATION

Downpatrick U.D.C. (No. 2). Portadown B.C. (No. 5).

ORDERS SUSPENDED

We regret to announce that since the last issue of *Smokeless Air* the following additional local authorities have been granted orders by the Department of the Environment to suspend the operation of their existing smoke control orders because of the present shortage of solid smokeless fuels.

Northern

8 December 1970-31 March 1971

Tyneside and Wearside

Blaydon U.D. (all operative orders).

Yorkshire

West Riding (North)

19 November 1970-31 March 1971

Rothwell U.D. (Nos. 1-12).

19 November 1970-30 April 1971

Dewsbury C.B. (Valley Road; Town Centre; Eastborough; Ravensthorpe Nos. 1 and 2; Thornhill).

8 December 1970-30 April 1971

Stanley U.D. (all operative orders).

North Western

South Lancashire and North-East Cheshire

25 November 1070-31 March 1971

Whitefield U.D. (all operative orders).

December 1970-30 April 1971

Bury C.B. (Nos. 2, 3 and 5). Farnworth B. (all operative orders).

December 1970-30April 1971

Middleton B. (Nos. 1-9). Prestwich B. (all operative orders). Sale B. (Nos. 1-4). Stretford B. (Nos. 1-4). Altrincham B. (Nos. 1-5). Dukinfield B. (Nos. 4 and 5). Manchester C.B. (St. George's Hulme; Wythenshawe; Bradford Road; Wythenshawe (extension); Collyhursh Street; Chorlton-cum-Hardy; Rusholme Road; Fallowfield and West Didsbury; City Road). Cheadle and Gatley U.D. (Nos. 1-5).

1 January 1971-30 April 1971

Urmston U.D. (Nos. 1 and 2).

Central Lancashire

3 November 1970-30 April 1971

Rishton U.D. (all operative orders).

1 December 1970-30 April 1971

Brierfield U.D. (all operative orders).

7 January 1971-30 April 1971

Church U.D. (all operative orders).

Merseyside

December 1970-30 April 1971

Bootle C.B. (all operative orders). Ellesmere Port B. (all operative orders). Bebington B. (all operative orders). Wallasey C.B. (all operative orders). Birkenhead C.B. (all operative orders.

London

Greater London Boroughs

November 1970-31March 1971

Camden (St. Pancras Nos. 1, 2, 3, 6, 8, and 9; Hamstead No. 12; Holborn Nos. 1-6), Newham (Nos. 3 and 4; West Ham No. 1). Bromley (Nos. 2-6; Chiselhurst and Sidcup (Mottingham North and South); Beckenham No. 2). Islington (Nos. 24, 26 and 28; North Islington Nos. 1, 2, 3, 4 and 7). Kensington and Chelsea (Holland Ward Nos. 1-3; Pembridge Ward Nos. 1 and 2; Norland Ward Nos. 1 and 2; Chelsea (Church Ward and Hanstown Ward No. 2)). Bexley (No. 7; Crayford U.D.C. Nos. 1-3). Barnet (Nos. 1, 2, 5 and 6; Barnet U.D. Nos. 2-6; East Barnet Nos. 1-6; Friern Barnet Nos. 2 and 3; Hendon B. Nos. 1, 7-13). Southwark (Nos. 18, 20, 22 and 24; Camberwell No. 4A; Bermondsey (London Bridge, Tooley St. No. 1 and Nos. 3-6); Southwark B.C. No. 4). Ealing (Nos. 3, 5, 14, 15-17, 22, 23, 31, 34, 37, 41, 42, 44 and 47; Acton B. Nos. 1-11). Brent (Nos. 1-5; Wembley Nos. 1-8). Westminster (Soho, St. Jame's, Regent, Grosvenor, Berkeley; St. Marylebone No. 4 (Ward 10); No. 5 (Ward 8); No. 6 (Ward 7); Paddington (Hyde Park No. 1, Lancaster Gate East and West, Westbourne Nos. 1 and 2)). Tower Hamlets (No. 2; Bethnal Green

B.C. Nos. 1-5). Wandsworth (Nos. 1, 2, 4-6).

December 1970-31 March 1971

Haringey (all premises situated to the north of the disused Palace Gates/Stratford railway line). Lambeth (Nos. 1-12, 15 and 17). Hillingdon (Hayes Harlington Nos. 1-21). Redbridge (Nos. 9-11 and 13; Wanstead and Woodford Nos. 1, 4 and 6; Ilford Nos. 1-6). Sutton (Beddington and Wallington Nos. 1-4; Carshalton Nos. 1-4). Enfield (Nos. 12, 14 and 16; Southgate Nos. 2-5; Edmonton *all* No. 2 and parts of Nos. 5, 6 and 15 i.e. all premises situated to the west of Great Cambridge Road). Kingston upon Thames (Nos. 1, 3, 5, 6, 8, 13 and 15; The Norbiton Estate No. 1). Barking L.B. (No. 11; Barking B. Nos. 3, 5 and 7; Dagenham Nos. 3 and 4). Richmond upon Thames (Surrey Nos. 1-5; Barnes Nos. 1-4; Twickenham Nos. 1-3).

Outer London

5 December 1970-30 April 1971

Dartford R.D. (all operative orders).

Local Authorities Outside the Black Areas

November 1970-31 March 1971

Southampton C.B. (all operative orders).

November 1970-30 April 1971

Lancaster B. (all operative orders). Bedford B. (Nos. 1 and 2). Basildon U.D. (all operative orders). Staines U.D. (Nos. 1-4). Thurrock U.D. (Kennington Estate, Aveley and Beltus Estate, South Ockden). Slough B. (Nos. 1-5). Rochester B. (all operative orders). Gillingham B. (all operative orders). Chatham B. (all operative orders). Northfleet U.D. (all operative orders).

ERRATUM

Smoke Control Areas (Progress Report)

In the Winter, 1970 issue of Smokeless Air, the total for acres outside the black areas should read 151,153 and not 1,063,544 as published. The grand total should therefore have been 964,180. The total for premises outside the black areas should have read 485,895 and not 3,338,956. The grand total for premises should therefore have been 4,778,369.

BOOK REVIEWS

Smoking and Health Now

A Report of the Royal College of Physicians. £1·50 net.

Being a moderately heavy smoker myself, I read this report with great interest. It has many facts which I have never heard of before and it is very true to say that smokers do not realise what damage they are doing to their health. When you have read this report the truth comes home.

Since its introduction in the 16th century, smoking has always had its advocates and opponents; only recently has scientific study produced valid evidence of its effects upon health. Premature deaths and disabling illnesses caused by cigarette smoking have now reached epidemic proportions.

The fatal effects of tobacco smoking are almost restricted to cigarette smokers, and increase with the amount smoked. Cigarette smokers are about twice as likely to die in middle age as are non-smokers and may have a risk similar to that of non-smokers 10 years older. It is estimated that over 20,000 deaths in men between the ages of 35 and 64 are caused every year by smoking in the U.K. The chances are that two out of every five heavy cigarette smokers, but only one out of every five non-smokers, will die before the age of 65. The man of 35 who is an average cigarette smoker is likely on average to lose 5½ years of life compared with a non-smoker.

Those who discontinue smoking cigarettes run a steadily diminishing risk of dying from its effects, even after many years of smoking, and attain the level of non-smokers after 10 years of abstinence.

Tobacco smoke has a complex composition. Its most important components are substances that can cause cancer in experimental animals, irritants that may cause bronchitis (the decline in deaths from this illness is attributed to cleaner air) nicotine that has many adverse effects on the heart and blood vessels and is probably responsible for tobacco habituation, and carbon monoxide that interferes with the blood's capacity to carry oxygen to the tissues of the body. Lung cancer has now been produced in animals which have inhaled tobacco smoke.

The world-wide rise in the number of deaths from lung cancer continues and many surveys have established a clear, quantitative relationship between numbers of cigarettes smoked and incidence of lung cancer. The risk is raised by habits such as inhaling. The risk is reduced, but not removed, by filtered cigarettes. Pipes and cigars appear to play only a small part in causing lung cancer, as does general pollution of the air.

Cancers of the mouth, larynx and oesophagus are more frequent in smokers of all kinds of tobacco than in non-smokers and cancers of the bladder and pancreas are more common in cigarette smokers. Diseases of the teeth and gums are more frequent in smokers.

The report says that if present smoking habits continue, it has been forecast that there will be some 50,000 deaths from the disease each year in England and Wales in the 1980s. If cigarette smoking were to cease there might in 20 years time be no more than 5,000 annual deaths from lung cancer.

The report says that every effort must be made to encourage people not to smoke cigarettes and at the same time to develop less dangerous products for those who cannot abstain.

For those who cannot give up smoking the following is advised:

smoke fewer cigarettes
inhale less
smoke less of each cigarette
take fewer puffs from each cigarette
take the cigarette out of the mouth between puffs
smoke brands with low nicotine and tar content.

The report also advises that the Government should look beyond this easy source of revenue to the realiy of the injurious effects of cigarettes on the health and economy of the country.

The report states that success in the prevention of diseases caused by smoking can be achieved, but only if the attack is effectively organised and made on many fronts. The goal is the preservation of the lives and health of thousands of smokers who would otherwise continue year after year to become ill and to die before their time.

Suzanne Martin

Reader Enquiry Service No. **7116**

Eco-Crisis

Edited by Cecil Johnson, 182 pages. John Wiley and Sons, New York/London. 1970. £1·55.

"Man cannot continue to perpetrate irreversible acts of destruction against our all-giving mother, the earth, and against the sky that surrounds her."

"Man has markedly altered the physical environment itself—as do all living things. But whereas the changes in environment promoted by other living things encourage renewal and turnover, man has in many cases disrupted the opportunities for rebirth."

"The fundamental problem in the world today is simply too many people multiplying too rapidly and placing demands on the world's resources that cannot be sustained."

"Man's incomplete understanding of many technological principles and natural forces is not necessarily to his discredit. Indeed, that he has erected empires despite his limited knowledge is to his glory. But that he pits this ignorance and uncertainty, and the fragile yet lethal technology he has woven out of them, against the uncertainties of nature, science and human behaviour, this may well be his everlasting sorrow."

"We are rightly appalled by the genetic effects of radiation, how then, can we be indifferent to the same effect in chemicals that we disseminate widely in our environment?"

"Even though we would like to dominate nature it still dominates us."

"Eco-Crisis" deals very comprehensively, in an anthology of excerpts and essays from 14 internationally renowned scientists and ecologists, not only with the dangers of fall-out; chemical and biological warfare; the soaring population; pesticides; air and water pollution and excessive noise, but considers in detail the whole historical background which has led to this ecological mess, and attempts to give immediate and long-range targets for effective action.

It is a very readable book and the facts and opinions are put forward in an easily comprehensible and convincing way. The editor hopes to "jolt the reader out of his complacency" and create an informed public—it is certainly a book to make one think more deeply about mankind's future.

Christine Smith

Reader Enquiry Service No. **7117**

Annual Report of the Scientific Adviser, Greater London Council, 1969. Price 18s.

This is a very comprehensive Report divided into six main parts: water pollution, sewage treatment and waste disposal; building materials for construction and maintenance; environmental studies; statutory; general supplies and services and general.

Environmental studies includes a section on air pollution. The Scientific Branch of the Greater London Council has continued the regular measurements of air pollution started in 1920. The routine measurement of smoke and sulphur dioxide in air is conducted in conformity with the National Survey of Air Pollution which is co-ordinated by the Warren Spring Laboratory of the Ministry of Technology. As a contribution to the survey and for general information, the Scientific Branch during 1969 maintained 13 daily volumetric instruments, 11 lead dioxide instruments and four deposit gauges. In addition the analysis was undertaken on behalf of other authorities of samples from one lead dioxide instrument and six deposit gauges. The results were submitted to Warren Spring Laboratory and summaries are published in the Annual Abstract of Greater London Statistics.

Results obtained by means of the volumetric instruments at seven representative sites in Inner London indicated a continuation of the slow decline, which has been noted since 1965, in the pollution of the air by sulphur dioxide. The average measured concentration of sulphur dioxide in 1969 was 161 microgrammes per cubic metre of air, about 70% of the level in 1955-56 before the Clean Air Act.

The average measured concentration of smoke at the same sites in 1969 was 51 microgrammes per cubic metre. This was approximately 12% higher than in 1968 but less than in 1967 and was only 26% of the estimated 1955-56 level. The Report suggests that to a certain extent the increase could be attributed to the colder weather during the year and says a temporary check in the progress of smoke reduction is also to be expected while the current shortage of smokeless fuel continues.

During 1969 the highest single daily averages recorded were 420 microgrammes of smoke and 880 microgrammes of sulphur dioxide, per cubic metre of air.

London has again had a year free from smog. The last smog occurred in December 1962, when the daily average concentrations of 2890 microgrammes of smoke and 4450 microgrammes of sulphur dioxide per cubic metre were recorded. The Report says that it has been suggested by scientists that the loss of the smoke 'blanket' over London has helped to disperse low-lying mist and gaseous pollutants, allowing the sun's heat to reach ground level. If this explanation finds confirmation, the Report states that the clean air programme pursued by local authorities over the last 15 years has produced a double benefit and it seems probable that London has seen the last of the smog for which it has so long been associated.

The limited amount of investigation on vehicle fumes carried out by the Branch so far has indicated that vehicles far outweigh chimneys as a source of the black particulate matter found in the air of congested streets. With regard to carbon monoxide it has been found that the concentration of 50 parts per million accepted by the Factory Inspectorate as safe for eight hours is rarely exceeded for more than five minutes at a time. During a recent Ministry of Technology survey of traffic black spots in five provincial towns, the measured concentration exceeded 30 parts per million for less than 1% of the time. However, the Report goes on to say that on general principles it is undesirable for the general public to be exposed to more than a fraction of the limit accepted as safe for industrial workers; and evidence has been put forward that concentrations of carbon monoxide well below the toxic threshold level may be sufficient, possibly in conjunction with the hydrocarbons or other pollutants in exhaust gas, to cause a lessening of mental alertness and concentration. In the U.S.A. standards of 10 to 20 parts per million of carbon monoxide, averaged over eight hours, have been recently recommended. The Report expresses the opinion that there seems to be no evidence in the limited amount of data available that similar standards are not already being met in this country.

The dispersal of traffic fumes is aided by the prevailing weather and the generally irregular building heights which give access to the wind. The Report suggests that the design of road systems which will promote a free flow of reasonably fast traffic will be beneficial by minimising the output of fumes and increasing the disturbance of the air which would help disperse fumes.

Other investigations of air pollution produced the following cases: the discharge of polluted steam which destroyed foliage, turned grass yellow and affected paint 400 metres away: the black dust found in a park near London Airport which turned out to be fungal spores common in New Zealand. It is possible that they were brought in by aircraft.

Christine Smith

Reader Enquiry Service No. **7118**

Boundary Layer Meteorology, Volume 1, no. 1, March 1970

In the present state of scientific communication the appearance of a new journal produces mixed feelings. Another journal always represents an unwelcome commitment, and yet one hopes that it might gather together a specialised field so that one doesn't have to take several journals, in each of which only one or two papers per issue are of interest. On this second basis we wish the editor, Dr. R. E. Munn, every success.

Boundary Layer Meteorology says it will publish one volume of four issues a year. It is to be hoped that it will resist the temptation to expand indefinitely. We may hope also that it will insist on brevity, because journals can serve a very valuable purpose in compelling authors to shorten the innumerable reports which are quite unreadable because of their length and whose main purpose seems to be to make the collection of waste paper economic.

The publishers (Reidel, of Dordrecht) have produced an attractive style, but there is doubt about the merit of much work in boundary layers. As a sort of outsider who sees the work from the inside I cannot help feeling that the workers in this field are talking to each other without having any message for anyone else. If the editors can make the subject come to life they will perform a valuable service, and they can do it by telling authors when they are boring. We have got to the stage when papers should be rejected because they are dull, too long, trivial, or obvious, and on that basis I would have returned half of this volume to the authors even though they are not wrong. But perhaps I would say the same of many journals. Too many much needed gaps in the literature are being filled.

This volume has little of relevance to air pollution and is mainly dynamical. The only exception is "A meteorological 80m tower near Rotterdam" by Professor Schmidt's group at de Bilt: a dull title but tucked away in the summary we find ". . . case histories are presented of an air pollution episode and of an hourly average wind direction difference of 120° over 70m". That should have made the headline!

R. S. Scorer

Reader Enquiry Service No. **7119**

Public Health Implications of Radioactive Waste Releases

By C. P. Straub, World Health Organization, Geneva, 66 pages. 50p.

Radioactive wastes present special public health problems that are not common to other wastes and are unfamiliar to many health authorities. Difficulties arise from the fact that there is no method of neutralizing or modifying the radioactivity of the wastes. Their decay rate is fixed, being a specific, invariable property of each radionuclide. Furthermore, radioactive wastes containing very low concentrations of radionuclides are usually disposed of by dilution into the environment. Once they have been discharged into the environment, in accordance with statutory limitations, no significant further control can be practised; they undergo dilution, retention, and reconcentration through the operation of natural processes, and under special circumstances may constitute a potential hazard to man.

The aim of publishing this book is to help the public health officer, who is usually concerned not only with radioactive contamination but with all aspects of environmental pollution. An introductory section discusses the role of public health agencies in safeguarding the population against radiation hazards and briefly examines some basic concepts. A short note on sources of radioactive wastes is followed by a description of various collecting systems for liquid, gaseous, and solid wastes, and advises on methods of sampling. The most important section concerns routes and techniques of disposal. It gives detailed recommendations for release to the water environment, to the air environment, and to the soil environment. Three annexes provide supplementary information on exposure pathways; sources, quantities and composition of wastes from nuclear operations; and operations research in liquid radioactive waste disposal.

Reader Enquiry Service No. **7120**

Small-bore Heating and Hot-water Supply for Small Dwellings

J. J. Barton, 153 pages, Newnes-Butterworths, £1·00.

This second edition has been greatly revised from the original work. The scope of the book has been extended to include two-pipe systems and the use of 10mm and 6mm bore sub-circuits. In this edition the SI system of measurement and decimal currency have superseded their imperial counterparts and more useful during the changeover to the metric system, is the appendices, which have been extended to include essential tabular design information in both SI and imperial units, and also notes on decimal currency. This book has been designed to meet the needs of all those designers and contractors directly concerned with domestic central heating and also to help young students and apprentices in the plumbing, heating and building industries, and also students of domestic architecture.

Suzanne Martin

Reader Enquiry Service No. **7121**

The Industrial Fuel Efficiency Diary 1971

Edited by H. B. Locke, published by H. O. Quinn Ltd., 35a Chapel Road, Worthing, Sussex.

This diary, which is now published for the second year, contains much basic, derived and related data for engineers, fuel technologists and all concerned with fuels, combustion, steam and power. This year, in addition to a large amount of useful data, charts and tables have had S.I. unit equivalents added and there is a section on metric conversions. There are some very useful maps of the Motorways and roads in the United Kingdom, together with space for memoranda and graph paper at the back.

Reader Enquiry Service No. **7122**

AIR POLLUTION ABSTRACTS

1219 Pollution Problems from Combustion Processes. Short, W. (Presented to Annual Conference of A.P.H.I. Blackpool, Sept. 1970. *In* Environ, Health, 78(II) Nov. 1970).

This paper considers, largely by discussing various practical problems, the difficulties that may have to be overcome in order to ensure the minimum of nuisance from the chimneys serving combustion processes. It is felt that in the fourteen years since the Clean Air Act has been in force, the problem of smoke emission from chimneys of industrial and commercial premises has been solved and that any emissions of smoke now occurring are so noticeable that they receive quick attention. The paper does not therefore use much space to discuss smoke emission except from a few special types of combustion plant. It is considered that the main problems now requiring attention are the proper control of chimney heights, the reduction of grit and dust emissions with the associated use of measuring equipment, and the consideration of the invisible emissions such as sulphur oxides and other noxious gases. The paper is followed by a discussion.

1220 Gasification of Lignite by the BCR Two-Stage Super-Pressure Process. Grace, R. J., Glenn, R. A., and Zahradnik, R. L. (Presented at the Symposium on Synthetic Hydrocarbon Fuels From Western Coals, A I Ch E, Denver, Colorado, 30 Aug.-2 Sept., 1970).

A long-range programme of gas generator research and development is being conducted at Bituminous Coal Research, Inc., for the Office of Coal Research, U.S. Department of the Interior. Current emphasis of the programme is the development of the BCR two-stage super-pressure process for the production of Btu pipeline gas from coal. This paper reports the results being obtained in the optimization of the second stage of the gasifier by operation of a 100 lb/hr process and equipment development unit (PEDU) using lignite, a western coal. In the 100 lb/hr PEDU, hot synthesis gas is generated internally by reacting benzene, oxygen, and steam in a simulated first stage. This Stage I gas entrains and gasifies a pulverised coal feed as it passes downward through an 8-inch diameter, 5-ft. long second stage. The conditions in this second stage closely approximate those expected in full-scale gasifier operation. In the operation of the PEDU with lignite at 1000 psi and exit temperatures from 1400 to 1600 F, direct yields of methane have ranged from 11 to 18 per cent of the carbon in the lignite feed, depending upon the partial pressure of hydrogen in the Stage 1 gas. Overall carbon conversions of 35 to 55 per cent have been obtained. In the integrated two-stage gasifier the unconverted carbon is completely gasified in Stage 1 to generate both the heat and synthesis gas required for Stage 2.

1221 The Errors in the Analytical Calculation of the Dispersal of Atmospheric Trace Substances (A Critical Comparison Between Measured and Calculated SO_2 Concentrations). Manier, Gerhard. (Staub, 30(1) Jan. 1970. English trans.)

The question of reliability of the calculated values for concentration frequently occurs in investigations into the propagation of trace substances in the atmosphere. A comparison was, therefore, made between about 2000 measurements, of SO_2 concentration in the vicinity of a sulphuric acid plant, and the corresponding calculated values. The agreement between the values is unsatisfactory. The causes of the disparities are discussed.

1222 Relationships Between Air Quality Measurement Methods in Japan and the United States—II, Suspended Particulate Matter, Benson, F. B., *et al.* (Atmosph. Environ. 4(4) July, 1970).

Measurements of suspended particulate matter in the atmosphere are commonly determined by the use of the high volume air sampler. Concentrations of sulfate, nitrate, and organic fractions of these measurements are also routinely determined in many countries. As part of the United States-Japan Co-operative Air Pollution Measurement Studies, parallel sampling employing the instruments and analytical methods from each country was conducted in Kawasaki, Japan, between January and February and between March and May 1966. A significant difference of results between the methods was found for suspended particulate matter. Fair agreement was obtained between analytical results of the sulfate, nitrate, and organic fractions. Relationships between the suspended particulate concentrations determined by these two methods are discussed.

1223 Apparatus for the Catalytic Removal of Noxious Substances from Engine Exhaust Gases. Berger, Heinz. (U.S. Pat. 3,503,716. March 31, 1970).

A device for the catalytic oxidation of automotive exhausts is described. In other devices, a reaction chamber contains a catalyst which promotes the oxidation of the combustible components of exhaust gases. Thus, residual hydrocarbons are converted to water vapour and carbon dioxide, carbon monoxide is converted to CO_2, and hydrogen is converted to water vapour. However, these devices are not able to sustain a wide range of gas input rates and thus cannot compensate for changes in engine speed. Also, the catalyst chambers have caused engine redesign problems, involved high equipment costs, and made replacement or repair difficult. The device described has a low cost; a high gas-treatment efficiency; and can be easily accommodated in the engine area. The gas is first passed through a pre-igniting compartment, then contacted with a metal oxide catalyst and secondary air for oxidizing its combustible components. The catalyst chamber is surrounded by a preheating compartment so that the incoming exhaust and secondary air are brought to a higher temperature for the catalyst reaction. Temperature controls regulate the supply of secondary air and the operation of the preheating compartment so that a temperature of 700-800°C. is maintained in the catalyst chamber.

1224 Can Natural Gas Help Us Survive on a Polluted Planet? Beiderman, Nicholas P. (Pipeline Gas J. 197(8) July, 1970).

The role of the natural gas industry in terms of the overall pollution problem is discussed. The most beneficial use of the existing supply of natural gas is considered. The areas of air, water, solid waste, and noise pollution are reviewed from a historical perspective through to present problems. Classification of pollution sources and emissions are given, as well as costs of control programmes, particularly in fuel substitution and fuel emission control. Domestic pollution, municipal and industrial waste, and thermal pollution are considered. Electric power generation is the largest source of thermal pollution. Even with the total

potential reserves, the gas industry cannot supply fuel to everybody in unlimited quantities. It is essential that government, industry, and individuals co-operate to ensure that natural gas is used beneficially, rather than simply conveniently.

1225 Can On-Site Incineration Solve a Waste Disposal Problem and not Create Air Pollution? Cross, Frank L. (Presented at the Air Pollution Control Meeting, Elizabeth, New Jersey, 1970).

The annual production of solid waste in the United States is approximately 140 million tons. The disposal of these wastes each year creates large quantities of airborne pollutants, including one million tons each of carbon monoxide, sulphur dioxide, hydrocarbons, nitrogen oxides, and particulate matter. Between the time that a community runs out of suitable land for sanitary landfill and the time when it can afford to construct a municipal or regional incinerator, on-site incineration is important in the community's waste disposal operations. Poorly designed multi-chamber units and poorly operated units have resulted in the discharge of large quantities of smoke from single-chamber incinerators. Some state and local control agencies are passing regulations lowering the particulate emission limit to 0·1 grain/cu foot. Many units will not meet these regulations without installing some type of control device, such as a scrubber or auxiliary burner. Some factors essential to good planning have been suggested by the Incinerator Institute of America: collecting and method of charging, ample space around the incinerator, adequate air supply, adequate draught, chimney location, and current local codes and ordinances.

1226 Pollution from Power Production. Hangebrauck, Robert P., and Spaite, Paul W. (Presented at the National Limestone Institute, Inc., 25th Annual Convention, Washington, Jan. 1970).

Emissions resulting from combustion, especially combustion of coal, are a large and growing factor in increasing air pollution levels. Sulphur oxides, nitrogen oxides, and fine particulate matter will increase several-fold over the next three or four decades, even if development of nuclear power generation is extremely rapid, but the most immediate and serious problem is posed by sulphur oxides. Coal cleaning for the immediate future, coal or lignite gasification or conversion for possible application further in the future, and liquefied natural gas importation need attention in fuel resource management. Both "throwaway" and product-producing processes need rapid development and application. New combustion processes, such as those using fluid beds may make better use of limestone in the dry state. Although combustion design and modification techniques are available for partial control of nitrogen oxide emissions from gas and oi-fired power plants, no control technique for coal-fired plants is under development. Methods of controlling particulates include the use of electrostatic precipitators, with and without mechanical collectors. Scrubbers and fabric filters for use in power plants are being evaluated while dry limestone injection and wet limestone scrubbing processes for control of sulphur oxides will be available shortly. The dry limestone injection proces consists of equipment to pulverise limestone and inject and distribute it into the high temperature furnace gases. It is calcined and reacts with SO_2 and oxygen to form calcium sulphate which is collected with the fly ash in the dust collector equipment. The wet scrubbing process is a more likely choice where higher sulphur oxides removal is required. Costs of controlling sulphur oxides are also discussed.

1227 Studies on the Removal of Sulphur Dioxide from Hot Flue Gases as a Measure to Prevent Air Pollution: IV. Recovery of Flue Gas Sulphur as Ammonium Phosphate. Kiyoura, R. *et al.* (J. of Air Poll. Control Assoc. 20(II) Nov. 1970).

The present development in industry has greatly increased the consumption of fossil fuel all over the world. The sulphur present in these fuels on combustion impairs the atmosphere and has to be removed before or after combustion. Direct desulphurization is still in its initial stage of commercial application and is thought to be rather expensive. Most projects today are concerned with flue gas desulphurization and a few people have been successful in the pilot plant scale. Flue gas sulphur is usually recovered as sulphuric acid or ammonium sulphate. The Kiyoura-T.I.T. process employs a completely dry method to recover this sulphur as ammonium sulphate. However, present trends in fertilizers show that there is a marked drop in the consumption of this type of fertilizer except for China and other Asian countries.

Experiments were carried out to produce a high grade phosphatic fertilizer with a larger field of application. The authors were successful in rendering the phosphate in rock water soluble by reacting it with the sulphate radical of the ammonium sulphate. Ammonium acid sulphate was used in the experiments and the phosphate radical was determined by a colorimeter utilizing the ammonium molybdate method. The results showed a conversion and extractability of 98 per cent, when the molecular ratio of ammonium acid sulphate to the CaO in phosphate rock was in the vicinity of 1:1·4-1·5. The reaction time was 120-180 minutes. The extracted liquid was crystallized and put through X-ray diffractometer experiments which showed that most of the crystals were ammonium phosphate containing about 15 per cent N and 39 per cent P_2O5 on a dry base. Thus, it is evident that this could be effectively applied in a commercial scale plant, recovering the flue gas sulphur as ammonium phosphate. The Kiyoura-T.I.T. process can be utilized to recover the flue gas sulphur either as the sulphate or as the prosphate.

1228 The Fight Against Air Pollution in West Germany. Kittner, Z. (Ochrana Ovzdusi, I, Sept., 1969. Trans. from Czech, Belov and Associates Denver, Colo. 1970).

In West Germany, about 2 million tons of ash, 4 million tons of sulphur dioxide, and about 6 million tons of carbon monoxide are emitted annually. Their sources include cement plants, power plants, and the chemical industry; motor vehicles; and home heating plants. The influence of topographical and weather conditions on pollutant concentrations is reviewed, as well as the effects of pollutants on man, animals and vegetation. Human lungs are particularly sensitive to attack from small dust particles, but pollution can also cause skin and eye damage. Plants are even more sensitive to pollution than man. Particularly dangerous gases like carbon monoxide, sulphur dioxide and fluoride are not visible in the air. The danger of carbon monoxide rests in the fact that it can replace the oxygen in blood pigmentation. Sulphur dioxide can hinder breathing and cause heavy damage to plants, particularly forest plants. To combat pollution the Federal Government is supporting research in many fields, particularly medicine, agronomy, meteorology, chemistry, physics, mathematics, and facility design. It is noted that because the concentration of pollutants in the atmosphere is frequently very low, complex methods and equipment must be developed to capture and measure them.

1229 City Planning and Air Pollution. Roussilbe, Andre. (Pollut. Atmos. 12. May, 1970. Text in French.)

The director of Planning and Housing in Paris discusses current problems in city planning as they relate to air pollution. City planning involves the zoning of industries to isolate them from residential areas; the centralising of home heating for increased efficiency in exhaust purification; improvements in the flow of traffic and parking conditions, as a way of reducing automotive exhaust problems and the maintenance of areas planted with vegetation. In density of permanent inhabitants, the city of Paris proper is exceeded only by Bombay, India, with 3 million Parisians living in an area of less than 10,000 hectares. Even Manhattan, in New York City, has a permanent population of only 1,900,000.

1230 Future U.S. Air Pollution Regulations. (Automobile Eng. (London) April, 1970).

If the number of cars in use increases at the expected rate, and no further controls are introduced, the minimum level of air pollution in the U.S. will be reached by about 1985. After 1985, the amount of pollutants in the atmosphere will increase again. Moreover, the 1985 pollution levels will significantly exceed those of 1940. Although stationary sources will discharge the larger proportion of nitrous oxide, motor vehicles will still be the major source of carbon monoxide and unburnt hydrocarbons. To meet regulations more stringent than those of 1972, it appears likely that cars will need both exhaust reactors and air injection pumps. Unfortunately, the widespread use of exhaust reactors could lead to severe problems with vapour locks and could impair power outputs and fuel consumption. It is possible, therefore, that other types of power units may once again become competitive, in particular the gas turbine and the Wankel engine. Exhaust emission data are presented for these engines and for engines with exhaust reactors and air injection systems, together with California and intended U.S. Federal regulations.

1231 The Analysis of Air Pollutants. Leithe, W. (Ann Arbor-Humphrey Science Publishers, 1970).

This book is a complete analysis of air pollution problems. An original contribution to the solution of these and related problems. The Analysis of Air Pollutants serves both as an introduction to the study of air analysis and a laboratory handbook containing detailed instructions on American, British and German analysis procedures. Leithe gives the analytical chemist and pollution control technician a synopsis of the various problems in the field of clean air maintenance: the origin and prevention of air pollution, emissions historical aspects, legislation and public measures, meteorological influences on the dispersion of waste gases, effects on man and vegetation, MIK values, etc. In addition, he deals with such pertinent topics as experiments with gas mixtures, analytical methods, measuring the special substances, and measuring air-polluting organic compounds. An author's addenda updates various portions of the book and increases its usefulness by supplementing specifically German data with information pertinent to air pollution engineers in the United States and other countries. This is a valuable book for air pollution and industrial hygiene laboratories.

1232 Tests to Assess Effects of Low Levels of Air Pollutants on Human Health. Ferris, B. G. (Arch. Environ. Health 21(4) Oct. 1970).

A variety of tests and techniques have been used to assess the effects of air pollution on human health. The identification of the effects of low levels of pollutants poses a different problem from that encountered in high levels of pollutants. Techniques that are applicable to high levels of pollutants may lack sensitivity for low levels. A review is presented of various tests and techniques which indicates the more productive existing methods and examines the areas where more studies are needed to determine sensitivity and specificity.

1233 A Sensible Look at Air Pollution by Metals. Schroeder, Henry A. (Arch. Environ. Health, 21(6)Dec. 1970).

Twenty-seven metals are considered in the light of present knowledge. Only seven are more or less toxic of themselves; of these seven, only three represent real or potential hazards to human health: nickel, cadmium and lead. Two others need careful control: beryllium and antimony. Beryllium is highly toxic. Of the other 20, nine are essential for mammals and offer no hazard except at very large concentrations; seven are probably inert when inhaled and the effects of four on human beings are unknown at present concentrations. Four, aluminium, barium, strontium and titanium are probably natural pollutants.

The author states that every effort must be made to abate the three metals with the largest potential toxicities. Cadium in the air can be minimized or abolished by abatement of zinc, from which it comes. Lead can be virtually abolished by eliminating alkyl lead additives to gasoline (one brand of high test gasoline now has very little lead). Nickel dust can be controlled by the usual methods for removal of particulates from emissions; nickel carbonyl must be treated to decompose it; nickel additives to gasoline should be prohibited, and methods for removing it from diesel engine exhausts developed. If measures for abatement were directed at these three toxic metals, particulate matter in the air would inevitably diminish.

1234 Progress in the Prevention and Control of Air Pollution. Third Report of the Secretary of Health, Education and Welfare to the Congress of the United States. (Document No. 91-61, March, 1970).

Amongst the accomplishments of the January 1968-December 1969 period, the following were particularly significant: The machinery for regional control of air pollution was set in motion in 25 air quality control regions. State governments have begun to adopt dioxide and particulate air quality standards for these regions.

In accordance with the intent of the Clean Air Act, there has been a very high degree of public participation in State hearings on air quality standards for the air quality control regions. The quantity and quality of citizen involvement are unprecedented in the history of air pollution control efforts.

With the beginning of the 1970 model year, more stringent standards for the control of air pollution from new motor vehicles went into effect. For the first time, smoke standards for new motor vehicles went into effect. For the first time, smoke standards for new diesel-powered vehicles were placed in effect.

Research and development work on low-pollution engines for motor vehicles was initiated. The initial projects relate to the design of Rankine-cycle engines for passenger cars.

There was a continued expansion of State and local air pollution control activities, there were increases in State and local air pollution control activities; there were increases in State and local expenditures, budgeted positions, and air monitoring activities and further progress in adoption of laws and regulations.

INDUSTRIAL NEWS

Atmospheric Pollution Limited By New Filter

In this, European Conservation Year, Redman Heenan Froude Limited, the Worcester engineering company, have introduced a new anti-pollution device—the 'Aeropur' Electrostatic Filter. Designed to suppress the emission of pollutants into the atmosphere, Aeropur, when coupled to industrial incinerators, boilers, dust extractors and other similar equipment, eliminates the emission of smoke, and limits the release of harmful gases into the atmosphere.

The Aeropur Filter is designed to handle 8,000 cu. metres of smoke/gases per hour at a temperature of up to 400°C. Running costs of the Aeropur are low—comparable to a 0·5 kW electric fire; and as the unit is itself an exhaust duct, the need for a chimney is eliminated. Moreover, there are no mechanical wear problems. Larger and smaller sizes will be available shortly. Utilising a combination of high voltage, continuous irrigation, coupled with the effects of a centrifugal water wash, Aeropur has proved 99·4% effective in the suppression of emission of particulate matter, down to sub-micron size, during the combustion of rubber tyres.

In addition to the virtually complete separation of even highly resistant dust, Aeropur also considerably reduces the emission of such harmful gases as SO_2, SO_3, Cl, Hcl, etc.

Dust laden gases from the incinerator enter the Aeropur's tower base through an involute entry port, where they are directed, by fixed helix, to a spiral path ascension. A central mast mounted upon an insulator carries banks of electrodes having multipoints to permit the corona discharge to ionise the dust particles.

The whole central mast assembly is at high negative potential (150 kV D.C. at 0·6 mA) while the tower acts as the earth return; therefore the resultant charged particles are attracted to the side plates where water irrigation washes them to the tower base, and thence to a settling tank, where the agglomerate can then be removed. This continuous particle removal obviates re-entrainment. The water can be re-circulated thus avoiding wastage and consequent high water costs.

The Filter is designed to handle gases up to 400°C (750°F) but should the crude gas have a higher temperature, then Redman Heenan Froude Ltd. can supply a water cooling system to reduce the gas temperature by spray injection. This additional water vapour in the gas allows agglomeration of the dust particle content, increases electrical conductivity and assists chemical reaction between aggressive gas constituents, resulting in a higher overall efficiency.

The Filter was demonstrated in conjunction with one of the standard range of Redman Heenan Incinerators burning tyres at the rate of 0·25 tons/hour. The set-up is, of course, quite suitable for burning smokelessly, practically all types of refuse.

Redman Heenan Froude's 'Aeropur' Filter will prove invaluable in reducing the risk of atmospheric pollution in those industries committed to the combustion of all forms of rubber, plastics, chemical and organic waste.

Reader Enquiry Service No. **7124**

The Filter in an inoperative state during the combustion of rubber tyres

The same exercise after 10 seconds, with the Filter in operation

Rumania Buys £25,000 Unit from Thurley

Masinimport, the Rumanian state machinery purchasing organization, has placed a £25,000 order with Harrogate combustion engineers John Thurley Ltd. for a submerged combustion type incinerator to destroy chlorinated hydrocarbons containing 84% by weight of chlorine.

The incinerator is designed to dispose of up to 730 lbs. an hour of difficult-to-destroy chemical waste. The plant converts chlorine into dilute hydrochloric acid.

A Vortex burner, using natural gas as an auxiliary fuel to maintain a high incineration temperature, is employed to incinerate the chlorinated hydrocarbons and to ensure complete conversion of all chlorine to hydrochloric acid.

The products of combustion then pass through a down-comer and are bubbled through water so that exhaust gases are cooled to 37°C. and the hydrogen chloride content of the gas is reduced to 300 mg/NM_3. After this primary cooling and scrubbing the gases are passed to a packed column where the hydrogen chloride content of the exhaust gas is further reduced by water washing to 10 mg/NM_3 before release to atmosphere.

Reader Enquiry Service No. **7125**

Thunderstorms Studied as Atmospheric Cleansers

Thunderstorms, the awesome weather disturbances that cause immense property damage yearly in the United States are also very useful, according to an Argonne National Laboratory scientist. Dr. Donald F. Gatz, a meteorologist with the Radiological Physics Division of Argonne, is studying thunderstorms to determine how effectively such storms cleanse the atmosphere of airborne particulate matter. The study is being financed by the U.S. Atomic Energy Commission as part of an investigation to determine how radioactive material is removed from the atmosphere. It is also important because many of the common atmospheric pollutants are removed in the same manner.

Dr. Gatz thinks that if we can understand how these storms remove particulate matter from the air we not only can gain an insight into the overall cause and effect of severe weather disturbances, but we may be able to make reliable estimates of how much airborne pollution the atmosphere will retain. This information could also assist measureably in the establishment of guidelines for air pollution limits in varying geographical areas.

Reader Enquiry Service No. **7126**

Association for Coal in Europe

The Council of the Association for Coal in Europe, consisting of the Heads of the West European Coal Industries (Belgium, France, Germany, the Netherlands, Spain and the United Kingdom) met in London on Tuesday (19th January). They discussed developments in the coal situation in Europe and the rest of the world and questions arising from Britain's application to join the European Coal and Steel Community.

The representatives of the continental coal industries expressed their concern and deep regret at the news of the impending relinquishment by Lord Robens of the Chairmanship of the National Coal Board. They paid tribute to his inspiring leadership of the British coal industry and to all that he had done in the cause of European economic integration. They felt that this change in the leadership of the National Coal Board and of the European coal industry was unfortunate at a time when Britain's entry to the Common Market was being negotiated and when important changes were taking place in the European and world energy markets.

Reader Enquiry Service No. **7128**

National Coal Board Appointments

The National Coal Board have appointed Mr. C. Round to a new post as Director (Special Duties) in their Production Department Headquarters in Doncaster. He will be succeeded as Deputy Director (Mining) of the Barnsley Area by Mr. W. M. Eaton, Managing Director of the Engineering Workshops at Tredomen, South Wales.

Mr. B. Goddard, Chief Mining Engineer in the Barnsley Area is appointed Head of Mining General Branch in the Production Department Headquarters. He is succeeded as Chief Mining Engineer, Barnsley Area by Mr. C. Shepherd, formerly Deputy Chief Mining Engineer in that area.

Mr. J. R. Cowan has been appointed Director of their Scottish South Area in succession to Mr. R. D. Glass, who is to retire.

Mr. W. Norman has been appointed Managing Director of Tredomen Engineering Works at Ystrad Mynach, Hengoed, Glamorgan. He succeeds Mr W. M. Eaton.

Reader Enquiry Service No. **7129**

Air Pollution Control Unit for Belgium

Part of John Thurley Export Order

Export orders from Belgium worth nearly £20,000 for anti-air pollution and specialised combustion equipment have been won by John Thurley Ltd. of Harrogate.

Acide Carbonique of Gossellies near Brussels have ordered an air pollution control unit to process exhaust gases from a paint spray booth and Metallergie Hoboken of Antwerp, have ordered natural and butane gas burners plus specialised controls for a copper melting furnace.

The air pollution control unit ordered by Acide Carbonique is an incinerator incorporating a Maxon Combustifume burner.

Reader Enquiry Service No. **7130**

Stainless Steel

The leading article in the winter 1970-71 issue of *Stainless Steel,* journal of the Stainless Steel Development Association, is entitled "Fighting the Pollution Menace" and it describes the contribution made by stainless steel in many fields, in the fight against pollution.

Reader Enquiry Service No. **7131**

More Danks Plant for Smokeless Fuel Production

Edwin Danks & Co (Oldbury) Limited (Babcock & Wilcox Group), has received a £233,000 order from Coalite & Chemical Products Limited for waste heat boiler plant and associated equipment.

This plant will form part of the new Coalite works at Rossington Colliery near Doncaster. When com-

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pleted in May 1972, these works will produce an additional 420,000 tons of "Coalite" Smokeless Fuel each year.

The Edwin Danks contract is for the supply, delivery, erection and commissioning of a new waste heat boiler plant, comprising three waste heat boilers and one economic boiler, together with the boiler house and associated equipment.

This order follows that placed by Coalite & Chemical Products Limited with Edwin Danks in March of this year, for similar equipment at Grimethorpe Coalite works. This contract is nearing completion and the plant is to be commissioned shortly.

Reader Enquiry Service No. **7132**

Noise Laws to be Investigated

Ways of strengthening the law against noise are being urgently examined by the Noise Advisory Council under its chairman, Mr. Peter Walker, Secretary of State for the Environment.

A working group under the chairmanship of Sir Hilary Scott, a former president of the Law Society, has been set up to prepare new proposals.

This is announced in a review by the Council of its first eight months work. Their most important conclusion is that the Noise Abatement Act 1960 is inadequate for modern day conditions.

The Council has already completed a survey of the main sources of noise disturbance in Britain.

Proposed reductions in maximum permitted noise levels from new vehicles, announced by Mr. Walker on 16th December 1970, have been welcomed by the Council. They are now looking for more effective means of enforcing the regulations limiting noise from vehicles.

An assurance that the Government will consult the Council before coming to a final decision on commercial supersonic flights over the United Kingdom has been given. In the meantime, the Council are preparing advice for the Secretary of State for Trade and Industry on the balance of social advantage in terms of noise disturbance, between spreading aircraft routes as widely—or concentrating them as narrowly—as possible. A Working Party under the chairmanship of Mr Epson are engaged on a detailed examination of this question.

Reader Enquiry Service No. **7135**

BCURA to Close

Addressing a meeting of BCURA staff on 14th January 1971, Mr. T. C. L. Nicole, Chairman of BCURA Council, said:

"The National Coal Board have reviewed, in the light of present circumstances, their programme of research into Coal Processing and Combustion and the resources needed to carry it out. They have decided to concentrate the work at their Coal Research Establishment at Stoke Orchard, near Cheltenham and to withdraw support from BCURA. We have to tell you that since the National Coal Board are the only members of BCURA, this means that the Association cannot continue as it is.

"It is expected that the present programme of work at BCURA will be finished by the summer and the Council of BCURA are considering how best they can assist in the resettling of staff."

Reader Enquiry Service No. **7136**

BICC Sets up Pollution Panel

British Insulated Callender's Cables Ltd. has set up a pollution panel, based at Prescot, Lancs., and consisting of divisional management representatives, representatives of the group's medical service and invited public health officers.

The aim of the panel is to consider the problems of pollution, not only applied to industry but also to the environment outside the factory. The first objective is to measure pollution rates to establish a base line for future activities and a pollution survey has been set up to measure as many as possible of the pollutants within two miles of BICC's Prescot factory.

While some of these may be produced in the factory others, such as lead and carbon monoxide, smoke and sulphur dioxide, as well as noise, are produced by the outside community. It is intended to monitor these jointly with local schools.

The necessity to include the community in the project stems from the desire to talk freely and openly about pollution so that the issues will become purely objective and not emotionally biased. It will also be part of the company's education system, in the hope that increasing awareness of pollution among young people will lead to better future control.

When the methods and baselines have been established successfully, the pollution panel will become an advisory body, able to tackle any local problems in the group when requested by general management.

Reader Enquiry Service No. **7137**

National Industrial Fuel Efficiency Service Board of Directors

The Secretary of State for Trade and Industry has appointed Mr W. Short, B.Sc., M.Inst.F., M.I.H.V.E., M.I.Nuc.E., a Director of the National Industrial Fuel Efficiency Service.

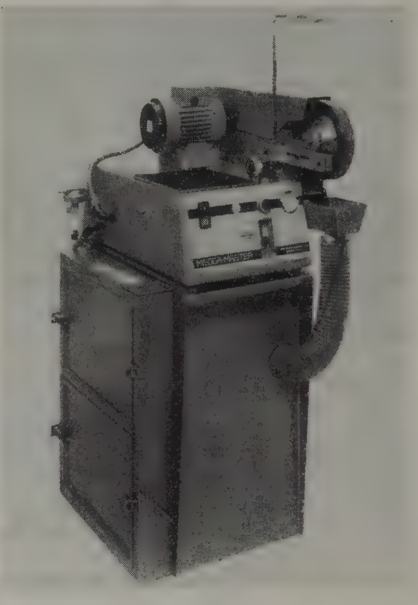
It will be remembered that Mr. Short presented a paper on the measurement and grit and dust at the 1970 Conference at Southport. The paper on incineration which he delivered to the 1970 Scottish Clean Air Conference is published earlier in this issue.

Reader Enquiry Service No. **7138**

New Appointment for Rexco

Principally responsible for capital projects with a major consideration for the new Rexco works at Snibston, Leicestershire, is Geoffrey J. Middleton, who has recently joined National Carbonising Company as Chief Engineer of the Carbonising Division.

Reader Enquiry Service No. **7139**



Harvey Torit Cabinet Dust Collector Supplied Complete with Megga-Master

Harvey Fabrication Limited, a member of the G. A. Harvey Group are now supplying their Cabinet Dust Collectors for use with Megga Master 1-52-UDC Machines.

The versatility of the Megga-Master 1-52-UDC is unique in the field of abrasive belt grinding/polishing operations. The Megga-Master Machine is mounted on top of the Dust Collector giving a compact design and saving in floor space.

The Harvey Torit Cabinet Dust Collectors are designed to filter all dust including extremely fine atmospheric particles such as grinding wheel and metal dust down to submicron size particles. Operators, therefore, no longer require masks as the dust is prevented from reaching their breathing areas. Cabinet Dust Collectors can be caster mounted and made easily portable for use anywhere in the factory. As a result they

can serve several machines without the use of long duct runs, and have a collection by weight efficiency of 99·7%.

Reader Enquiry Service No. **7140**

Coke Replaced by Gas in Foundry Breakthrough Opens Way for Massive Fuel Switch

A breakthrough by Northern Gas Board engineers opens the way for a massive fuel switchover in iron foundries throughout the country and could do much to ease the acute national shortage of coke.

The engineers have found a way of replacing by gas about half the coke used in iron melting furnaces. The development follows many unsuccessful attempts in this country to replace coke for this purpose with either gas or oil and foreign achievements in this field have not so far been accepted in this country.

The national shortage of metallurgical coke and its high price mean that foundries all over the country are now, as a result of this new technique, expected to change to gas firing. Altogether about 500,000 tons of coke could be replaced.

The breakthrough has come at the Darlington works of John Vickers & Sons Ltd. The works has two cupolas, the name for the iron melting furnaces, each with a capacity of 1·8 tons per hour. The Northern Gas Board were allowed to convert one of them to supplementary firing on gas provided normal production schedules could be met.

Conversion work and the subsequent exhaustive testing were carried out with no interruption to production.

The tests showed that the maximum economic coke replacement for this particular furnace was 45%. In addition, output was increased by 25%, grit emission was considerably reduced, and both metal temperature and quality was maintained. Success at John Vickers is regarded as complete. The firm is to change over their second cupola to gas firing and the total cost for both conversions is expected to be recouped within 2½ years.

The breakthrough for gas has come at a typical jobbing iron foundry. But in the Netherlands successful conversions of up to 10-ton capacity and up to 50-ton capacity in the United States have been achieved.

Reader Enquiry Service No. **7141**

ITT Reznor Launch Direct Fired System

ITT Reznor—one of Europe's largest manufacturers of gas fired industrial and commercial heating equipment—has introduced an air movement system designed to provide maximum efficiency in controlling the atmosphere in buildings or parts of buildings where operations can adulterate the air.

The principle of the system—known as Direct Fired Make-up Air (DFMA)—is, simply, to replace contaminated air with filtered fresh air, either heated or unheated according to the prevailing weather conditions and environmental requirements. DFMA is exclusive to the gas industry and applications can be found in a wide variety of businesses. Among them are: hotels, restaurants and canteens; potteries; foundries; tanneries; and paint shops.

Reader Enquiry Service No. **7142**

Cutting the Cost of Collecting Data on Air Pollution

Modern aids which cut the cost of time and manpower of carrying out field surveys on air pollution was demonstrated by Warren Spring Laboratory at the International Clean Air Exhibition, held in Washington D.C. from December 6th-11th, 1970.

Through the introduction of more sophisticated equipment it is now possible to devise comprehensive and flexible systems for collecting and processing automatically information on pollution and meteorological conditions.

The Laboratory has been developing for a number of years the use of battery operated samplers and associated selective switching and data logging equipment.

Four systems were on show by the Laboratory:

Data Logging

Field data loggers can be used on mains or be battery operated and can accept and record data on magnetic tape from up to four input channels. Each tape can accept about 10,000 readings and is returned to the Laboratory for translation and computer analysis.

Directional Sampler

This is essentially a wind vane and anemometer mounted on a 10-metre mast. It is used to control the sampling of pollution according to wind speed and direction and its electronic outputs can be logged to provide a record of meteorological conditions during the sampling periods.

Automatic Station

This gives automatic telephone warning of the imminence of high levels of pollution in the London area. The field unit may also be interrogated by telephone from the base station; the unit then transmits data from five channels in sequence.

High Speed Data Transmission

This system is used, for example, to monitor emissions from chimneys. A number of sulphur dioxide recorders and meteorological equipment downwind of a chimney are connected to the data transmission equipment. These instruments are left switched on but not recording. The outputs from the six data channels are encoded and transmitted as a multiplex through the telephone answering machine. At the base the data are received by a similar answering machine and decoded.

Reader Enquiry Service No. **7143**

New Edition of "Standards for Automatic Gas Burners"

A second edition of "Standards for Automatic Gas Burners, Forced and Induced Draught" has been published by the Gas Council.

The first edition was published in 1966 and has resulted in virtually every automatic gas burner produced today being built to conform to it. It is a statement of the essential requirements of standards of safety on which guidance was being sought from the gas industry by manufacturers and users of automatic gas burners and components.

The new edition results from advancing knowledge of the subject arising from continuing studies.

Single copies of the Standard are available free on application to the Gas Council (Industrial Engineering Department). Bulk orders will be charged 15p per copy.

Reader Enquiry Service No. **7144**

Standard Specification for Open Fireplace Components

In spite of the many alternative forms of heating available, the domestic open fire still retains its popularity and it is desirable that components of suitable quality are used in its assembly. A British Standard dealing with these components was issued in 1945 and was revised in 1959, the later issue consisting of four separate parts.

In view of the close association between the various parts, the need for revision in metric terms has provided an opportunity to combine the four parts into one volume, which is now available as BS 1251: 1970 Specification for open fireplace components.

This British Standard deals with the fireback, the fireplace surround and hearth, the chimney-throat restrictor, if used, and the lintel above the fireplace opening, all of which need to be dimensionally compatible.

Manufacturers of products complying with this standard may apply to BSI to use the Kitemark. This is a

registered trade mark used only under licence from BSI, the presence of which indicates compliance with an appropriate British Standard.

Copies of BS 1251: 1970 may be obtained from the BSI Sales Branch, 101 Pentonville Road, London N1 9ND. Price by post 70p (subscribers 60p). Remittance with order for non-subscribers.

Reader Enquiry Service No. **7145**

Vokes Win Contract for Taiwan Nuclear Reactor

The Air Filter Division of Vokes Ltd., Henley Park, Guildford, have obtained the contract for specialized filtration equipment for a new nuclear reactor in Taiwan.

The £13,000 order was successfully negotiated by Vokes' Canadian agent, Diamond-Canapower Ltd. It was placed with Vokes by Canatom Ltd. for Atomic Energy of Canada Limited, the principal contractor for the project.

Vokes were selected because their suggested arrangement of Supervee Pre-filters and Absolute filters combined within their Unipak System was superior to and simpler than the equipment originally specified; at the same time, it was recognised that Vokes have extensive experience in this critical field of filtration. This equipment has already been proved in many countries including Japan, Germany, Belgium and Holland, and has also recently been ordered by Nuklearni Institut Josef Stefan, Ljubljana, Yugoslavia, for a new research reactor.

The Vokes Unipak Systems that were specified contain up to four stages consisting of Pre-filters, Absolute filters, Carbon Packs for the absorption of radio-active iodine and After-filters.

Safety factors are vital in the maintenance of such equipment and the Unipak System meets the essential requirements by virtue of a patented sealing mechanism that permits remote location and sealing of new filters; consequently the individual filter stages can be changed by the operator with greater safety.

This 40MWt research reactor will be fuelled with natural uranium and moderated with heavy water. It will be built at Huaitzupu in the North West of Taiwan and incorporates many design improvements.

The reactor vessel (calandria) will be fabricated entirely of zirconium alloy, using techniques which have recently become available. All control and instrumentation will use solid-state equipment and digital data-logging will be used for information retrieval.

Reader Enquiry Service No. **7146**

Glossary of Industrial Furnace Terms

The British Standards Institution has published BS 4642: 1970 Glossary of industrial furnace terms, which gives a definition of terms used in the main industries which utilize furnaces. The standard was originally intended to form a new part of BS 1846 and be restricted to solid fuel, but it was found that the Society of Industrial Furnace Engineers (formerly the Society of Furnace Builders) had already prepared a suitable document not restricted to any particular fuel, and this was adopted as the base for the British Standard. The glossary does not cover commercial catering or laboratory processes and does not deal extensively with metallurgical work, in view of the specialized nature of equipment used in these fields.

The glossary is composed of nine sections. Sections 1 and 2 cover, respectively, general terms and terms for processes carried out in furnaces; the remaining sections deal individually with particular fields of furnace work, from melting and smelting of metals to drying, baking and metal coating.

Copies of BS 4642: 1970, may be obtained from the BSI Sales Branch, 101/113 Pentonville Road, London N1 9ND. Price by post 85p (subscribers 70p). Remittance with order for non-subscribers.

Reader Enquiry Service No. **7147**

Performance Requirements for Reactive Smokeless Fuels

Examples of the brightly burning type of smokeless fuel used in domestic open fires have been available for several years, and others have been developed comparatively recently after years of research by the producers. They have been marketed so readily that already there is a great diversity of products—and qualities—in the field.

The committee responsible for BS 3142 Manufactured solid smokeless fuels for household use has been studying the preparation of a specification for reactive domestic smokeless fuels since 1965, and this has now been completed and published as Part 3 Specially reactive fuels for all types of domestic open fire.

In view of the proliferation of fuels in this category it was felt that the most satisfactory guide to quality would be their heat output. The specification is therefore based on the calorific value and combustion characteristics of the fuel supplied. However, each of the fuels considered has special characteristics which make it attractive to particular consumers and for this reason the specification has been framed in order to ensure that these fuels are of consistent and satisfactory quality on leaving the producer's works—it does not attempt to define the relative characteristics which might influence a choice between them.

Copies of BS 3142: Part 3: 1970 may be obtained from the BSI Sales Branch, 101 Pentonville Road, London N1 9ND. Price by post 85p (subscribers 70p). Remittance with order for non-subscribers.

Reader Enquiry Service No. **7148**

Contract Placed for Prototype Battery Electric Buses

The Department of Trade and Industry has placed a contract for the production of two prototype battery electric buses for use in city centres. The vehicles are to be manufactured by Crompton Leyland Electricars at Tredegar, Mon., and will be delivered during the second half of 1971. They are intended to provide information from which local authority transport undertakings will be able to evaluate the suitability of this type of vehicle for their own particular conditions.

As the effects of exhaust pollution are most keenly felt in city centres, there is increasing interest in the possible use of battery electric buses. Although such vehicles have been in existence for over a century they have as yet found little application in the field of public transport.

Power for the prototype vehicles will be provided by lead-acid traction batteries and the vehicles will have a range of about 30 miles under city centre traffic conditions, with a top speed of 20 miles per hour. The batteries will normally be recharged overnight or partially recharged during rest periods in the day. Complete battery sets will, however, be rapidly interchangeable thereby enabling spare, charged batteries, to be employed to extend to daily mileage of the vehicles.

The vehicles will be approximately 21 feet long and will weigh about 9 tons. They will carry 18 standing and eight seated passengers and space for hand baggage will be provided.

It is intended to loan the buses free of charge to transport authorities to enable them to gain first hand knowledge of the operating and technical characteristics. Both buses will carry instruments to record energy used, range, speed, etc. and this information can be used to specify production vehicles for use by local authorities that decide to add electric buses to their fleets.

The first vehicle will be placed initially with Leeds City Transport and later, together with the second vehicle, will be available for use elsewhere.

Reader Enquiry Service No. **7149**

Joint Meeting of the London, Northern Home Counties and South-Eastern Centres of the Association of Public Health Inspectors, Church House, Westminster, 10 December, 1970.

A discussion entitled "The Control of Environmental Pollution" was opened by Mr Iliff, deputy chairman of Shell Chemicals U.K. Ltd., and a member of the Royal Commission on Environmental Pollution.

Mr Iliff's thought-provoking talk covered the whole range and history of pollution. He said one of the most serious problems today was not industrial pollution itself but the subsequent effects following the use of industrial products—such as plastic waste. He thought that if everyone involved in industry, from the researchers and designers to the people selling the product, were all personally concerned and willing to co-operate, this could have a "snow-balling" effect on pollution prevention. He gave examples of what had already been achieved in pollution prevention when concentration and effort was really brought to the problem.

He was rather dubious about the possible long-term effects of pollution-quoting the "Greenhouse effect" and the "Second Ice-Age", and thought that it was more important to concentrate on short-term measures where we know the effects. He felt existing legislation should be properly enforced, and extended in some cases.

He said problems in other countries should not be ignored because the same conditions do not prevail here. He gave the example of motor-car exhausts, saying that although this problem could be exaggerated by reference to other countries with different conditions, it was, nevertheless, a problem.

He summed up by saying that all pollution control, whether in the air, water or on the land, needed a large amount of national resources—hundreds of millions of pounds—to back up the technology that was already to a large extent available. He felt the responsibility of individuals was very important, both in exerting their influence as members of a community and in the education of others.

Mr Iliff's talk was followed by the 1966 Shell Unit film about the river Rhine—"The River Must Live". River pollution and ways of combating it by the treatment of urban and industrial wastes were shown in a superb blending of clear, though unpleasant facts and excellent photography. As the chairman, Mr J. W. Bevan, said afterwards, "A must for every trainee Public Health Inspector."

Mr Ward and Mr Stringer, both Fellows of the Association of Public Health Inspectors, then opened the discussion.

Mr Ward took up Mr Iliff's point about motor vehicle exhausts and said that control had been thwarted in this country because there were no proven ill-health effects. He questioned the validity of medical evidence, which had not stopped other countries from introducing legislation in this field, and advocated the banning of all petrol and diesel engines from congested areas and suggested the use of electric vehicles.

Mr Ward agreed that legislation should be properly enforced and felt that this was the duty of local authorities. He pointed out that the Clean Air programme was not so successful as it seemed. Only 50 per cent of premises in the country were covered by smoke control orders and these were mainly in the South and not in the more heavily polluted areas in the North. With regard to water pollution Mr. Ward said that 148 local authorities still discharged untreated sewage into our seas and rivers and that the low standards for industrial effluents implemented many years ago had still not been met.

He said more careful planning was needed in the expansion of urban areas and the building of new towns to cope with the ever-increasing population. Planning needed to be a multidisciplined effort and not something rushed into and tidied up afterwards.

He finished by saying that people were far more aware of the problems of pollution and there were many more organisations concerned with the environment and these should be coordinated.

Mr. Stringer said that it was easy to overstate the case of pollution. Intensive legislation in some places tended to force problems elsewhere. He gave the example that industries cannot afford to control pollution and also remain competitive and this may mean they dump toxic wastes, etc., and so cause other problems. He doubted that the oceans had infinite resources to purify and said there was a need to find geologically safe places to dump toxic wastes so they will not affect underground waters, etc.

Mr. Stringer pointed out that it was often the non-understanding worker that caused such things as oil-spillage and not industry collectively. There was a great need to educate the individual in order to eliminate these mistakes, although obviously accidents could still happen.

The discussion was then thrown open to the floor. Speakers from various specialist organisations concerned with the environment spoke about their work and all agreed that more education was needed to make people fully aware of all the different factors of pollution and that co-operation and careful planning was essential. Several felt that more action and less talk was needed and that we should not wait until things became a nuisance before dealing with them.

Mr. Iliff closed the discussion by commenting on the points made and the meeting ended with the vote of thanks.

Christine Smith

OBITUARIES

Mr. George W. Tate, who died suddenly on 8th January 1971, at the age of 71 was the Chief Public Health Inspector of Ashington U.D.C. from 1937 until his premature retirement due to ill health in 1962 and he was one of the founder members of the North East Divisional Council when it was formed on the 8th February 1949. From its inception he played an important part in the affairs of the North East Division and became Honorary Secretary in June 1950, which office he filled until 1961 when he was forced to give up because of ill health.

After his retirement Mr. Tate continued as an individual member of the Society and all members of the North East Division who knew him will long remember him for his forthright and uncompromising attitude against air pollution in a location which is virtually the heart of the northern coal producing industry.

Mr. Jimmy Rodgers, one of the gas industry's nationally-known commercial personalities, died suddenly at his home in Alston Avenue, Sale, Cheshire, on 25th November 1970, after a short illness. He was 62. Mr. Rogers, a former Sale councillor, served the gas industry for 44 years, and until his retirement in 1968 was domestic sales manager of the North Western Gas Board.

Mr. Rodgers was also widely known for his work on clean air, and upon his retirement was appointed to act as a consultant to the North Western Gas Board on clean air matters. In this capacity he continued to represent the Board on the North Western Division of the Society, of which he was twice chairman.

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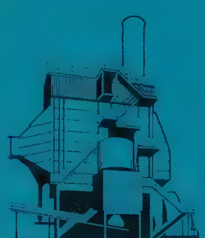

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

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Principal Contents

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ABC

"This most excellent canopy, the air"

CLEAN AIR

At the time of writing the whole country is concerned about the Census. Indeed, most people will already have filled in their forms ready for collection by the enumerator. There has been much talk about the questions asked and whether these are necessary, and there has been further speculation about questions which were not asked but which might have been. Certainly one of the questions which has not been asked was "Are you concerned in the protection of the environment and helping to make the world a better place in which to live?"

Every member of the National Society for Clean Air is a member of such an organisation, and the very fact of membership is an expression of the member's concern with the world in which we live and in which future generations will have to live.

One of the main concerns of the Census is to give clear indications of the increase in the population and the manner in which they live. At the same time that the national Census is being carried out, the Society is concerned, at the end of its financial year, with the auditing of accounts and a census of its own membership. Unlike the national Census this is an annual event and it is easy to see trends. We are happy to be able to say that membership of the Society has, shown a slight increase; but this increase is very small and membership of the Society has really remained static over the past few years. At the same time, audits of the past years have indicated only too clearly the rising costs of operation in all fields and have pointed, amongst other things, to the necessity for an increase in income to meet such costs.

One of the ways by which this can be done is by increasing membership. But we should not seek to do this just for the sake of an increase in income but with the avowed intention of interesting many more people in clean air and the environment. During the last 12 months there was an awakened interest in the environment partly as a result of the publicity that was given to European Conservation Year. How much of this was lip service and how much will be lasting, time alone will tell, but there is no doubt that we, as a Society, should take advantage of this awakened interest to carry out a recruiting campaign and try and increase our membership in all classes.

This is a very easy thing to say; indeed one often hears the phrase "we should seek to increase our membership". But it is a much more difficult task to carry out. Many people are able to say it but few, in fact, do very much about it—except express their views on how some one else might do it! To maintain membership is difficult enough because of lapses through death in some cases, by amalgamation of local authorities, by the taking over of firms and not last, by the objection to subscriptions having to be raised.

So far, we have managed to maintain the status quo and to show a slight improvement. But if a real all-out effort were made by every member of the Society, whether they be a private individual, a local authority, a small firm or a large industrial undertaking, could have very real and far reaching results. There is no doubt that the best recruiting sergeant is the contented member. If every member, in whatever category, produced one new member of a similar kind, this would double the size of the Society. May, we therefore, ask every member of the Society to try and do just this?

It is important that we do expand. It is important that we obtain new blood. And above all it is important that we obtain the support of the rising generation, capture their interest and harness their activities so that they are trained and ready to carry on the work of preserving the environment, and clean air in particular, for generations yet to come.

Pollution Course in Schools

Sixth formers starting advanced level GCE studies next September may be able to take a course on the environment and pollution.

A syllabus for A-level Environmental Studies is to be submitted to several examination boards shortly by a working party of school teachers and university lecturers. It proposes that the course should include such topics as spoilation of the countryside, soil erosion, deforestation, and noise and pollution in towns. Part of the course would be a field study of a particular environment problem.

CLEARING THE AIR

by

F. E. Ireland, B.Sc., C.Eng., F.R.I.C.

Chief Alkali Inspector, Department of the Environment

Lecture delivered by the 1969 George E. Davis Medallist of the Institute of Chemical Engineers at the University of Manchester Institute of Science and Technology on 10th November 1970.
This lecture is published by kind permission of the Institute of Chemical Engineers, Belgrave Square, London S.W.1.

It seems appropriate for a chief alkali inspector to be giving this Memorial Lecture in Manchester, for George Davis was at one time an alkali inspector when the headquarters of the inspectorate were in Manchester. What is an alkali inspector? Nearly 10 years ago *Punch* asked this question in the following verse after the inspectorate had been named in the Answer to a Parliamentary Question.

The Guardians

O potent Minister of Power!
What news is this in danger's hour?
Pray, how and when did we create
The Alkali Inspectorate?

I see them—kindly autocrats,
With bits of litmus in their hats,
Parading early, testing late,
The Alkali Inspectorate.

The taste of tar is on our tongues,
The breath of hell is in our lungs,
But firm they stand 'twixt us and Fate—
The Alkali Inspectorate.

E. S. TURNER

The first Alkali Act was passed in 1863 following the recommendation of a Royal Commission and its purpose was to control the emission to air of hydrochloric acid gas from the first stage of the Leblanc saltcake process for making alkali or sodium carbonate. The first chief inspector was Dr. Angus Smith, F.R.S., a remarkable man of many interests who set the policy pattern of the inspectorate which has been followed ever since. Dr. Smith appointed on to his staff a small number of eminent scientists who were men of vigour and character and who became interested in the development of industrial processes. Each man had a small laboratory of his own at the home from which he worked and he received a laboratory allowance of £20 per year. There were but few qualified scientists in those days and the inspectors performed researches in controlling emissions. Dr Smith and his colleagues were not content to restrict their activities to alkali works and they found many opportunities to examine emission problems at different types of industrial processes. As during the present day, their advisory services were frequently used by local authorities in many industrial spheres.

George E. Davis and the Alkali Inspectorate

It was to this august body of men that George Davis was appointed. The staff records of that time are incomplete and the first mention of George Davis was in May 1878 when he was described as the sub-inspector for District 2 covering East Lancashire, Yorkshire, and Midland Counties. When he joined the inspectorate, the Alkali Act 1874 had strengthened control over alkali works emissions, but Dr. Smith cast his net much wider and his early reports go into great detail about the composition of air and rain—especially in Manchester—coal smoke, copper smoke, and the effect of pollution on health and vegetation.

George Davis entered into this work with enthusiasm and early showed his interest in conservation and the systematic scientific approach to industrial problems. His first major contribution was the improvement of spray chambers for concentrating or evaporating liquids such as caustic soda and the alkaline solutions of paper works by passing products of combustion through the sprayed liquids. Earlier models had resulted in the emission of dark smoke, but Davis showed that by proper attention to temperature, residence time and turbulence all the smoke could be consumed. He was able also to make good use of waste heat for pre-heating liquids to be evaporated. This work is reported by Dr. Smith in the Annual Report for 1880.

However, it was the Alkali Act of 1881 which gave George Davis his big opportunity for studying many industrial processes and gave him the knowledge and experience later to become the first practising chemical engineer. The new Act included alkali works, sulphuric acid works in all cases except when attached to copper works by the furnace process, chemical manure works, gas liquor works, nitric acid works, sulphate of ammonia and muriate of ammonia works, chlorine works, cement works, and salt works.

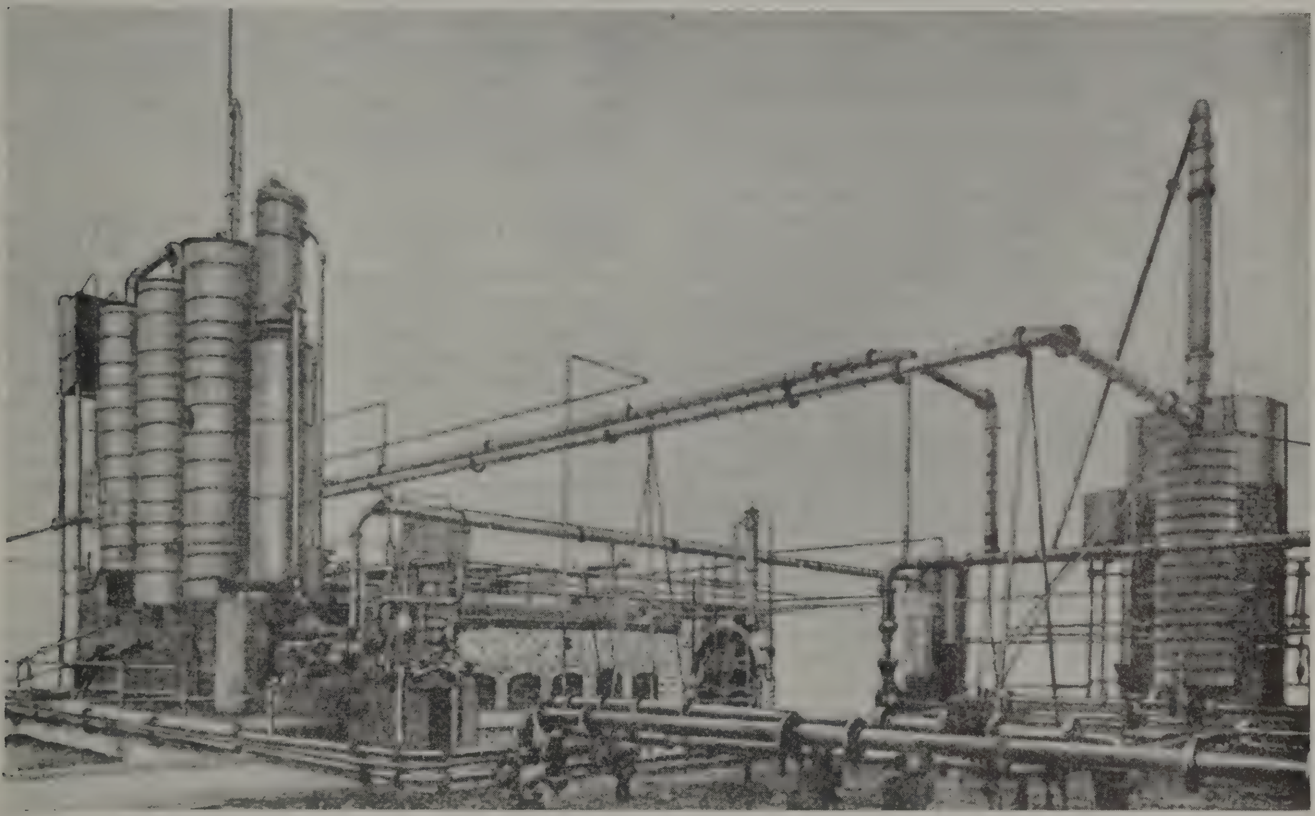
Five districts were formed to cover the United Kingdom and George Davis was put in charge of the Midland district with R. Forbes Carpenter as sub-inspector. At this time was introduced the system whereby each district inspector wrote his own district report which Dr. Smith inserted into his published annual report. We thus have a record of Davis's work in his own words. He immediately began a campaign against low-level escapes of gaseous pollutants from registered works, especially alkali and sulphuric acid works, a facet which had received minor attention while the greater initial problem of efficient condensation was being given priority. In the 1881 Report he criticised the faulty construction of flues leading to inadequate draught and mentioned the co-operation of managements in correcting these matters. He goes on: *"Still it would be preferable to find manufacturers considering their plans more fully and scientifically before they commence to build."* In the same Report he criticised the design of condensers and retort construction in sulphuric acid manufacture.

Turning to gas liquor works, George Davis warned of the dangers of hydrogen sulphide and recommended its absorption in oxide of iron and lime purifiers, thus providing a source of sulphur for sulphuric acid production. He deprecated the burning of hydrogen sulphide to sulphur dioxide, which *"simply changes the character of the nuisance and does not abate it"*.

Although tar works were not then scheduled under the Alkali Act, Davis had plenty of opportunity for seeing them in operation at works registered for other processes and he criticised some of the malpractices he saw, especially the discharge of residual pitch from the stills at too high a temperature, resulting in the emission of dense, pungent fumes. After twice complaining of these emissions at one works, he records: *"The manager did not seem to regard this as anything serious, so I supposed it of frequent occurrence."*

An important development in process control was mentioned by Davis in his references to chamber sulphuric acid plants: *"We have also done much to encourage the regular testing of the chamber exits, informing the owners that they could not be considered as using 'the best practicable means' unless this were done."* He goes on to complain about 10 works carrying on the manufacture without any scientific supervision whatever. He leaves his most caustic remarks for chemical manure works, especially those using fish and flesh, most of which had no condensing equipment for preventing the escape of noxious gases.

In 1883 Davis and Carpenter carried out a comprehensive investigation of air pollution at Castleford following complaints of damage to vegetation. It was alleged that damage was caused by the alkali and acid works, but their report laid the blame mainly on glass works emissions. Mr. Davis summarizes his report by stating *"that the chief cause of the damage to vegetation is the extremely unwholesome emanations from all the glass works, with which we cannot interfere, and to a much smaller degree to the emanations from the chemical works, which are well within the limits the Act has laid down"*. Despite the seemingly incontrovertible evidence produced by Davis and Carpenter, the chief complainant refused to believe that the alkali works were not the sole cause of damage.



First Continuous Tar Still

Davis gave special attention to cement works which were placed under the alkali inspectorate only for purposes of study with the object of making recommendations to the local government board. They evolved a very dense white vapour, accompanied by "empyreumatic odours" resulting from the semi-destruction of the organic matter contained in the clay mud. Davis had samples of the white powder deposited in the flues analysed and discovered that it consisted of 66% of sulphate of potash, a very valuable salt which he thought should be recovered.

In his later reports Davis continued his campaigns for conservation of useful chemicals escaping to air, prevention of low level emissions, absorption of hydrogen sulphide, and the proper application of science to design and control. Referring to alkali works he says: *"The supervision is good, and as a rule the processes are conducted on scientific principles."*

Davis's district, known as Midland, embraced East Lancashire and Yorkshire in the north, through the counties in the centre of England, to Middlesex, Hampshire and Wiltshire in the south. It was a vast stretch requiring a lot of travelling and he and Dr. Smith carried on a public argument about it in the Annual Reports.

There is no doubt that Davis's energies and scientific approach to the problems of his district had resulted in a

great advance in noxious vapour suppression by 1883 and this he was able to report at the year end. His report for 1883 was his most comprehensive and found him as critical as ever of those who worked by rule of thumb. He finished with a set of rules for absorbing hydrogen sulphide in iron oxide, which he thought "may be of use in guiding others to a good work".

This was to be George Davis's last annual report. Dr. Angus Smith died shortly after he had signed the 1883 Annual Report in April 1884 after 20 years as chief inspector. His successor was Alfred E. Fletcher, who had been with him from the start in 1863. George Davis resigned his position as inspector in June 1884. His own successor as district inspector paid tribute to Davis's work in destroying obnoxious waste gases and recovering sulphur from hydrogen sulphide.

"In this the managers acknowledge their indebtedness to the late inspector of the district, Mr. G. E. Davis, for his valuable advice as regards construction of the destructor furnace."

A letter from a works manager to the inspector concludes:

"On the general question of the changes from the combustion method of dealing with the foul gases to the oxide absorption of them, I feel that so far as it refers to the circumstances connected with these works, I can say nothing but what is favourable. . . . It has not required the force of an Act of Parliament to induce us to abandon the old process, but I think it would need such a power to compel us to revert to it."

These were exciting and formative times for George Davis, for he was helping to formulate policies which have existed in the inspectorate to this day. I have dealt at some length with his work as an alkali inspector, because the George E. Davis story of those years is similar in many respects to the story of the alkali inspectorate today. There are still the same endeavours to educate works managements into the use of more advanced methods of process control, planned maintenance and, of course, sound basic design. Revolutions in industry are taking place faster than ever before and new problems of air pollution control are continually presenting themselves for solution. Chemical engineers are in an excellent position to cope with these situations because of their basic knowledge of process operations. Davis was their creator and he owed much of his inspiration in this sphere to his work as an alkali inspector. Although the chemical scene has apparently changed almost immeasurably since Davis's time, the new structure is still made up of the same bricks that Davis postulated and his fundamental concepts of chemical engineering still remain.

United Kingdom Legislation and Achievements

The four countries making up the United Kingdom all have similar legislation and policies on air pollution control but I am going to use those for England and Wales as my example because I am directly concerned with them.

Control of emissions to air is both local and national and in my view it is essential to have a good blend of both for best results. Local government control is mainly exercised through the Public Health Act 1936, the Public Health (Recurring Nuisances) Act 1969, and the Clean Air Acts 1956 and 1968. It is also possible for local planners to use the Planning Acts for "prior approval" by means of conditions and this form of control is being used increasingly. National control is exercised through the Alkali &c Works Regulation Act 1906 and the regulation-making powers of the Clean Air Acts.

To get matters in perspective, there are some 300,000 commercial and industrial premises in this country and we can guess that about 30,000 are sufficiently important to need the special attention of control authorities. Of this number, nearly 1,700 are registered under the Alkali Act for the operation of almost 3,000 scheduled processes. The scheduled processes cover much of the chemical industry, petroleum works, metallurgical works, electricity generation, gas and coke, cement, lime ceramics, and the like, where a knowledge of combustion and physico-chemical processes is necessary for proper control. These special industrial processes burn or treat about three-quarters of the fuel used in the country.

The Clean Air Acts have been a major force in the improvement of the environment in this country during the past decade although there has been a natural change in domestic heating practice which has helped enormously. These Acts have been vigorously enforced by many local authorities. Smoke control areas have been set up and the numerous low-level sources of smoke emission from domestic fires and commercial and industrial furnaces are well on the way to control. There is still a long way to go and the domestic fire is still our major national problem.

One of the problems of local authority control is uniformity of interpretation of legislation and its enforcement. This has been largely overcome, partly by the issue of central government advisory memoranda on such subjects as chimney heights, grit and dust, and cold blast cupolas, and partly by the regulation-making powers given by the Acts to the Minister of Housing and Local Government. These allow him to make requirements for the measurement of particulate emissions from industrial sources and to set limits on such emissions. Numerous conferences, lectures, and articles in association journals are media for exchanging information and gaining uniformity of policy by local authorities.

The results of measures to control pollution since the Second World War are reflected in the obviously cleaner environment, better health records, and measurements of pollution. It is estimated that, since the Clean Air Act 1956, smoke emissions have been reduced to such an extent that average ground level concentrations in urban areas have decreased by 60%. Sulphur dioxide concentrations at ground level have also been reduced, but to a lesser extent. Many will have seen or heard of the report prepared for the London Boroughs Association on *"The Progress and Effects of Smoke Control in London"*. This refers to benefits from the splendid progress on smoke control, which vary from 70% more December sunshine and a threefold increase in winter visibility to increases in the number of plant types and bird species to be seen. Ten years ago graphs of pollution by "smoke" and "sulphur dioxide" bore a direct relationship to graphs of mortality and morbidity in London. During the last few years this relationship has disappeared.

Many factors have combined to bring about the nationwide improvements. Over 4½ million premises, including more than half of all premises in the black areas, are covered by smoke control orders; we have controls over chimney heights and requirements concerning grit and dust arrestment plant for new industrial furnaces; we have the control over special industrial processes under the Alkali Act; and we have the voluntary move to use cleaner and more easily controlled fuels domestically, industrially and commercially.

The efforts of local authorities to improve their environment are a saga of their own best told by their spokesmen. My own work is the administration of the Alkali Act and in the remainder of this lecture I am going to describe the policy and some of the problems of the inspectorate.

The Work of the Alkali Inspectorate

The first Alkali Act of 1863 was followed by a number of further Acts adding more processes and noxious or offensive gases until the Alkali &c Works Regulation Act 1906 consolidated all the earlier Acts. The 1906 Act is still the operative legislation and it is purely a measure to control emissions from certain specified industries. The Public Health Act 1926 gave the Minister power to add to the list of scheduled works and noxious or offensive gases by means of Orders, after consultation with interested parties and the holding of Public Inquiries, without the formality of introducing legislation through Parliament. Eight such Orders were laid between 1928 and 1966 and the last revoked all earlier Orders and consolidated them in the Alkali & Works Order 1966.

The main provisions of the Act are briefly as follows:

(1). All scheduled works must obtain a certificate of registration which is renewed annually—the Stamp Duty of £6 (£10 for Alkali Works), which was paid annually up to 1970, was abolished by the Finance Act 1970.

(2). No new scheduled works is allowed to begin operating unless it is fitted with the best practicable means, to the satisfaction of the chief inspector, for preventing the emission of noxious or offensive gases. An important exception is in the case of works existing when the Act came to be applied to them, when they are accepted as they stand.

(3). All scheduled works must use the best practicable means (*a*) for preventing the emission of noxious or offensive gases and (*b*) for rendering such gases harmless and inoffensive where they are necessarily discharged.

(4) The expression "best practicable means" has reference not only to the correct use and effective maintenance of equipment installed for the purpose of preventing emissions to air, but also to the proper control by the owner of the process giving rise to the emission.

The plan of campaign is for the chief inspector, assisted by his two deputies, to formulate broad national policies, preferably gaining the approval of representatives of industries concerned, and for these policies to be applied at site level and in detail by the district inspectors, inspectors, and individual works managements. Plenty of flexibility is left for inspectors to negotiate with works managements to suit particular circumstances of local topography, siting, existing background pollution, meteorology, new production capacity, etc., and inspectors are made as autonomous as possible in their own districts. They are given a job to do and are left to get on with it while head office acts as a co-ordinating and advisory body.

There is a long history of co-operation between industry and the inspectorate and industry is offered a partnership with the inspectorate in finding solutions to its difficult technical problems. Working parties and discussion groups are set up, consisting of representatives of the industry, its research association, if any, and the inspectorate. The emissions are investigated by the three partners, research and development being carried out by the industrial side with their own specialists and at their own expense and results are reported to both the industry and the inspectorate. The chief inspector makes the final decision on any standards and requirements, for he is ultimately responsible, but this only follows mutual discussions with the industrial representatives whose approval is gained if possible. This participation by the trade associations is a good guarantee of their support in gaining implementation of the final requirements by their members, for they are anxious that all similar works in the country should have to meet approximately the same standards after due allowance is made for differences in siting.

In order to help industry and the inspectors to judge what constitutes "best practicable means", the concept of presumptive standards has been evolved. Only in four cases does the Alkali Act lay down statutory standards and for the rest of the scheduled works the chief inspector has set presumptive standards which he can alter at will as new and more efficient methods of operation and arrestment are developed. The standards are usually dual purpose in that the first part deals with permitted concentrations and mass emissions of noxious or offensive gases from the chimney, depending on the practicable prevention efficiency; and the second part deals with the dispersion of the residual gases so as to render them harmless and inoffensive.

If money were unlimited, there would be very few, if any, problems of air pollution control which could not be solved fairly quickly. We have the technical knowledge to absorb gases, arrest grit, dust, and fumes, and prevent smoke formation. The only reason why we still permit the escape of these pollutants is because economics are an important part of the word "practicable". Most of our problems are cheque book rather than technical and attitudes which take little account of the economics of scarce resources, on which there are many claims, can so easily blur the importance of the right choice of priorities.

The designer and engineer have many interrelated alternatives to take into account in planning new plants. Where corrosion and erosion are to be overcome, should costly impervious materials of construction be used, or should cheaper replaceable units be made? How far should equipment be duplicated in case of breakdowns, *e.g.* fans, pumps, electrical precipitators? Much will depend on the value of the product and the consequences of failure. A breakdown which interferes with the amenities by producing black smoke or releases inert dust is by no means so serious as a breakdown which might result in the massive release of a highly toxic material, such as chlorine, phosgene, hydrogen sulphide, or tolidine di-*iso*cyanate.

The design problems facing the industrialist and the inspectorate are concerned with how far we can go along the road to perfection in protecting the public without financial embarrassment to the industry, or individual works, a small community or even the nation, for in the long run it is the public which pays, directly or indirectly.

There is no finality about the best practicable means for controlling emissions from industrial processes. Industry cannot stay still; it is either progressing or declining and presenting new problems. Revolutions are occurring continually and there are many examples of new processes being invented, dominating the production scene and then being supplanted by newer processes or cheaper routes to the same end-product. This results in a constant battle for the inspectorate to cope with new situations and to satisfy the ever more stringent requirements of the public for cleaner air. In the following pages some important examples of industrial problems are used to demonstrate the work of the inspectorate.

Chemical Processes

Acid droplets

In the early 1950's the inspectorate's attention was focused on the increasing number of scattered complaints of pinhole damage to clothing. Incidents were reported under different circumstances from many parts of the country. Studies showed that some, but by no means all, of the complaints were in the neighbourhood of chamber sulphuric acid plants, which at that time still accounted for some 40 per cent or so of the country's acid production. Inspectors made a critical examination of all the chamber acid plants in the country but no abnormally high total acidities of the emissions were found and the plants were operating much as they had done for many years. A further study of the complaint details revealed that the damaged clothing was made of synthetic fibres and included such things as ladies' stockings, baby clothes, pram covers, underwear drying on the line after washing, etc. It seemed therefore that the vital element of the emission might always have been present but had not damaged the natural fibres which had previously been used almost exclusively for fabric manufacture. This proved to be the case. The droplets were first detected by placing large indicator papers in arcs downwind of acid-plant chimneys. The next stage was to examine chimney emissions more directly, either at the tops of the chimneys where these were accessible or through openings cut in the chimney stacks. Glass plates of measured size were exposed in the gas stream for times of one to five minutes depending on the extent of the emission, the upstream side was washed with distilled water into a basin and titrated with standard alkali so that a rough quantitative assessment could be obtained. Physical examination under a microscope showed a wide range of droplet sizes varying from about one micron to two millimetres. The weight of acid droplets emitted from a chamber acid plant was very small, amounting to only a few pounds per day, but one droplet can easily ruin a nylon stocking. A simple and inexpensive solution was sought and this was found in the form of two or three layers of "Venetian-blind" type arresters set in an increased cross section of chimney about three or four feet square. Rigid p.v.c., one-quarter of an inch thick, was used as the material of construction. Pressure drop was about five velocity heads per layer and usually amounted to not more than 0·2 inch water gauge. Collection efficiency was over 99 per cent on many installations. More sophisticated methods of measurement and arrestment have since been adopted on some units.

Following the experience with chamber acid plants an examination was made of all systems where gaseous emissions had been in contact with liquids and in most cases droplet carryover was found. These included contact sulphuric acid plants, nitric acid, fertilizers, water and caustic scrubbers, and miscellaneous processes and remedies were sought. It is now a requirement that all emissions be fitted with droplet arresters where necessary. Even when droplet emission is efficient, gases which have been in contact with liquids still carry sufficient sub-micron droplets and vapour to wet metal surfaces such as ducts and chimneys. Experience has shown that when the velocity of the gases exceeds 30 feet per second, liquid is physically torn from the sides of the chimney and carried into the air. Much as we desire to improve dispersion of waste gases by high efflux velocities, we have adopted the practice of limiting waste gases which have contacted liquids to a chimney velocity of 30 feet per second.

Fumes and mists

It is comparatively simple to arrest solid particles down to 10 microns diameter and liquid droplets down to one micron. Below these sizes an increasing force has to be used to divert particles from their paths in order to arrest them. They tend to behave like gases and move round obstacles. A high mechanical or electrical energy has to be used to capture them and the basic types of arrestment plant available for this task are electrical precipitators, fabric filters, and Venturi scrubbers, although there are variations of these. One of our most annoying problems is that of emissions from sulphur-burning, contact, sulphuric acid plants. Some are extremely visible as a white cloud because of acid mist, others are not. Some have misty emissions when making oleum, *i.e.* 100 per cent sulphuric acid in which sulphur trioxide is dissolved, and yet the same plants operate with invisible plumes when making 98 per cent acid. The result cannot be predicted prior to commissioning and as our requirement is an emission substantially free from persistent mist, space has to be left for later interposition of mist arrestment plant if needed. The visibility of the plume depends on the size of the mist particles in each individual case, the smaller the particles the greater the visibility caused by scattering of light, so that no figure can be put on a standard. We have found some emissions to be mist-free at 0·05 grain per cubic foot (115 mg/m^3) and others have had to be brought down to 0·015 grain per cubic foot (35 mg/m^3) or lower before they were acceptable. Electrical precipitators are expensive but are known to effect a cure. Knitmesh arresters are sometimes effective, sometimes not, while candle-type filters have given satisfaction. Thirty-three contact acid units are fitted with mist arresters in England and Wales.

Emissions of phosphorus pentoxide have to be reduced to something of the order of 0·01 to 0·02 grain per cubic foot (23 to 46 mg/m^3) before emissions can be regarded as satisfactory.

With a few exceptions such as those mentioned above, it is generally sufficient to reduce fume and mist concentrations to below 0·05 grain per cubic foot (115 mg/m^3) to produce an emission which is almost invisible and satisfies the community. Fumes of iron oxide from steel refining are a special case and are discussed later.

Oxides of nitrogen

In the chemical industry the chief problems with oxides of nitrogen arise from the manufacture of nitric acid and those chemical reactions which cause nitric acid to be recovered as a by-product, *e.g.* nylon production. A considerable amount of attention has been focused on oxides of nitrogen in recent years for the part they play in air pollution. By far the largest mass emission arises from combustion processes by fixation of nitrogen from the air. The greater the temperature and the greater the pressure, the greater is the amount of oxides of nitrogen produced. At one time process was developed for the production of nitric acid by means of an electric arc. The most significant source of these oxides is from motor vehicle exhausts. The Los Angeles lachrymatory smogs derive from the peculiar atmospheric conditions which cause oxides of nitrogen and unburnt hydrocarbons from motor vehicle exhausts to combine by photochemical reactions. One of the products is ozone and it is interesting to note that, to date, all the "first alerts" which have been sounded in Los Angeles have been due to the concentration of ozone rising above the set standard of 0·5 part per million. Compare this with the permitted limit for ozone in factory atmospheres in Britain of 0·1 part per million and one can well understand the reason

for tough legislation on vehicle exhausts in those parts of the world which suffer from photochemical smogs. So far there is no evidence of trouble from this type of pollution in Britain but as the air is cleared and actinic radiation from the sun penetrates our atmosphere more strongly we must keep a careful watch on this facet. Before this can happen it is to be hoped that motor vehicle exhausts will be under better control for other reasons.

Reverting to nitric acid plants, all use the process of catalytic combustion of ammonia with air, followed by the oxidation of nitric oxide to nitrogen dioxide and its absorption in water to form nitric acid. These steps can be represented as follows:

$$4NH_3 + 5O_2 = 4NO + 6H_2O \quad (1)$$
$$2NO + O_2 = 2NO_2 \quad (2)$$
$$3NO_2 + H_2O = 2HNO_3 + NO \quad (3)$$

It will be seen that nitric oxide is continually being reconstituted in reaction (3) and has to be reoxidized by the excess air present. Its concentration is continually decreasing and the velocities of the reoxidation and absorption reactions become progressively slower until they reach the stage where it is no longer economic to recover nitric acid from the dilute gases. These gases then pass to air and produce the well-known yellow-brown emission which causes local concern. Coloured emissions disturb the public more than do white emissions, partly because of the aesthetic effect and partly on account of the belief that they are more harmful. Nitric oxide is colourless and it is the nitrogen dioxide content which is responsible for the brown colour. Without going into details, new technology since the Second World War has made it possible to operate nitric acid plants with less and less emission of oxides of nitrogen. Shortly after the War, the chief inspector reduced the limit of permitted acidity from 4·5 grains per cubic foot (10·45 g/m^3) expressed as NO to 2·25 grains (5·2 g/m^3). This was later reduced to 1·5 grains per cubic foot (3·45 g/m^3) expressed as NO. We have now reached the transition stage to further improvement and while new standards have not yet been set, new nitric acid units are being required to improve their emissions in several ways. There is no evidence of a health hazard being involved because tall chimneys are required to give adequate dispersion of the waste gases according to Table I.

TABLE I.—*Heights of Discharge for Nitric Acid Plants*

Throughput (tons/day)	175	350	530	700	1060
Basic chimney height (feet)	180	250	300	350	400

The basic chimney height has to be adjusted by the inspector to take account of background pollution, other adjacent manufacturing processes, heights of nearby buildings, local topography and micrometeorology, etc. It is always our policy to reduce acidity to the practicable minimum but perhaps the more important feature of nitric acid plant emissions is the aesthetic effect of the yellow-brown plume. Recent work has been concentrated on colour reduction. There are now three nitric acid works operating with catalytic tail gas reduction in this country. This process depends for its economic practicability on the availability of a cheap source of fuel, such as is obtained at oil refineries. The process exists in two stages, the first of which mainly decolorizes the emission by reducing nitrogen dioxide to nitric oxide while only slightly reducing total acidity and the second stage reduces much of the nitric oxide to nitrogen and thereby reduces the acidity, too. The results are very good but even so the claims made for this process are not always sustained when we get down to hard bargaining about details. Another method being tried is to dilute the final emission with about 10 times its own volume of air. This is expensive in power and although complete decolorization is not achieved, it is acceptable to the local public. A third solution is to build more absorption capacity into the system and so reduce the final acidity and the colour, while not eliminating the latter. All three methods are being evaluated with a view to making more positive requirements in the future.

Iron and Steel Industry

The iron and steel industry is a vast industry which has presented the inspectorate with one of its most difficult problems since it was scheduled in 1958. It is not possible to review all the problems and solutions in a paper of this kind and a few snippets of information only are given.

In 1959 production in England and Wales was 12 million tons of pig iron and 18 million tons of crude steel. In 1969 the corresponding figures were 14·5 and 22·8 million tons.

Ore preparation and blast furnaces

In 1959 there were some 20 sinter plants producing about 8·5 million tons of sinter per year. In 1969 sintering was practised at 18 works with 38 sinter strands producing 20 million tons of sinter per year. The object of sintering is to beneficiate poor ores and to make graded material of suitable physical characteristics for the blast furnace. At the start of our responsibility arrestment of dust was crude and inefficient, where it existed, and efficient arrestment was only practised on a few new units. There were no standards of emission and we can only estimate that dust emission was equivalent to about 1 to 2 per cent of the sinter made. There are two large sources of dust in the sintering process—from the strand gases and from the hot discharge end. It seemed that the most obviously unacceptable emission was from the discharge end where clouds of dust filled the air. Moreover, because of the sintering action it was gritty and sharp. The inspectorate immediately asked for the main effort to be concentrated on the discharge gases and for high efficiency arresters to be installed. Later, as new sinter plants were planned and with the experience of several years' operation behind us, high efficiency arrestment was required on both strand gases and discharge gases. During 1969 a survey was made of emissions from all sinter plants in the country and the average dust emission was a little below 0·2 per cent of sinter made. Emissions from the latest plants fitted with the most modern high efficiency arresters were almost 0·25 per cent of the sinter made and this represents the target for the future.

Grit and dust are not the only emission problems of sinter plants. The plumes are characteristically misty and this is thought to be caused by sulphur trioxide. The ore, coke, and fuel for promoting combustion all contain sulphur and it appears that the iron oxide acts as a catalyst to convert some sulphur dioxide to sulphur trioxide. Tests have been carried out on the chimney emissions to determine the sulphur trioxide content, but the results are not reliable and the British Steel Corporation is testing recently developed apparatus in order to obtain more accurate assessments.

In the past, fluoride emissions from sinter plants have caused concern to cattle farmers, because of alleged fluorosis in the cattle eating grass on which fluorides have been deposited. The modern sintering process incorporates lime in the raw mix so as to form a self-fluxing sinter. This lime fixes a significant proportion of the fluorides in the sinter and the smaller amounts which are emitted are further reduced by the high efficiency arrestment units installed on modern plants.

There are minor proportions of many other elements in the emission and these, together with products of combustion and the pollutants mentioned above, pose a problem of dispersion. Tall chimneys are currently used and although several existing plants have been fitted with new, taller chimneys, there are still three sub-standard.

All I will say about blast furnaces is that in 1959 it was regular practice to bleed excess, dirty gas to air from the tops of the furnaces, without cleaning, at about 15 grains of solid matter per cubic foot. In addition to this deliberate bleeding, accidental "slips" were common and usually occurred several times a day, allowing dirty gas to pass to air through the bleeders. The present requirements is that any excess gas bled to air shall have passed through at least two of the three stages of arrestment. During the past 10 years enormous strides have been made in blast furnace control and it is now normal for furnaces to operate for about six months between "slips".

At the end of 1969 there were 63 operational blast furnaces in England and Wales, of which 55 were fitted with three-stage arresters and eight with two-stage.

Crude steel

In 1959, about 80 per cent of the steel production of England and Wales was by the open hearth furnace of which there were about 330. Measurements showed a dust burden of the waste gases within the range of 0·05 to 0·5 grain per cubic foot (0·115 to 1·15 g/m^3). None was fitted with arresters. There were 10 Bessemer converters—the greatest air polluters in steel refining—none of which was fitted with arrestment plant because the containment problems have never been solved in a practicable manner in any country. There were about 150 small electric arc furnaces, none of which is recorded as having been fitted with dust or fume arresters.

About the time iron and steel works were scheduled under the Alkali Act, in 1958, a major revolution in steel making was just beginning. Oxygen became available in tonnage quantities and was used to remove impurities by blowing through or on to the molten metal. Whereas the turnround cycle for an open-hearth furnace was 12-14 hours, that for the new L-D process using oxygen was one-half to one hour. The reaction is much more violent and causes vast quantities of dense brown fumes to be emitted at temperatures up to 2000°C. In Britain, all new pneumatic processes of steel-making were fitted with fume arrestment plants from the outset, the required standard of emission being 0·05 grain per cubic foot (0·115 g/m^3) which results in an almost invisible plume when it is achieved. With other countries, with whom information is regularly shared, we have pioneered arrestment plant for extremely onerous operating conditions and the results have frequently been far from satisfactory. Alterations and extensions have often had to be made and there are still many difficult hurdles to surmount. Time is needed to get all units to an acceptable condition. I now want to illustrate our difficulties by reference to electric arc furnaces using oxygen for refining.

(*VLN Bessemer Furnace Emission*)

When the question of arrestment plant for iron and steel refining was being considered the explosion hazard was assessed. During refining carbon is removed from the molten metal as carbon monoxide which, in the presence of excess air, burns to the harmless carbon dioxide. In the case of small electric arc furnaces fumes are allowed to escape from furnace doors and electrode ports where they are collected by hoods placed over the furnace and led to arrestment plant, usually bag filters. Carbon monoxide burns as it meets air on leaving the furnace. When large electric arc furnaces are used the expense of hooding the furnace and dealing with enormous volumes of waste gases and excess air in large filters is excessive. Volumes are kept practicable by removing fume directly from the furnace by close-fitting ducts but this introduces an explosion hazard, especially when arrestment is by electrical precipitators. At first it seemed that a dilution ratio of 22 parts of waste gas, including excess air, to one part of oxygen used in refining would be needed to ensure complete safety but this defeated the object of direct extraction and small volume. It was assumed in this first assessment that no combustion of carbon monoxide occurred. A fresh assessment was made and by using Le Chateliers's theory and Coward and Jones equations for explosive mixtures it was calculated that a dilution ratio of approximately four parts of waste gas to one part of oxygen used would ideally bring the carbon monoxide content below the lower flammability limit, provided that carbon monoxide burnt and the products of combustion acted as a diluent. As a safety precaution it was decided to accept a minimum dilution ratio of seven to one. Combustion had to be ensured. The alkali inspectorate's preferred method was an intermediate combustion chamber fitted with an independent flame source supplied with its own forced air. This has been used successfully, although some works have relied on an adjustable slip ring for air infiltration.

When the systems were put into practice, explosions were encountered, not from carbon monoxide during refining but from hydrogen formation during melt-down. A major source of hydrogen was the carburizing anthracite put in the bottom of the bath before adding scrap metal, another source was from grease and oil on the scrap, and a third source was thought to be from the humidity of the atmosphere. It is surprising how little gas mixing takes place in large ducts. Strata of air and gas can travel parallel to each other and trouble is experienced at the point of mixing. Explosions have also been encountered in L-D type vessels when slugs of undiluted carbon monoxide have passed along large ducts, met air inleakage and been sparked-off in electrical precipitators. It is noteworthy that one modern technique now being used in this country is completely to enclose the L-D type vessels and remove undiluted gases when they are above the upper explosion limit, for cleaning and subsequent burning in a controlled manner.

Large electric arc furnace emissions are still only a partially solved problem. Heat input is enormous, furnace atmosphere conditions at any moment are heterogeneous, and it is impossible to apply suction uniformly over the whole furnace. For metallurgical reasons a controlled atmosphere has to be maintained and some leakages from doors and electrode ports are inevitable. During charging, when the furnace roof is swung to one side and fume collection is disconnected, there is a dense emission for a short time and a lot of the fine fume finds its way into the atmosphere through the roof ventilators.

The preferred modern method is semi-direct- extraction by means of a combination of direct extraction and hoods. Trials are being prepared for shop atmosphere extraction as an addition to the above so that an assessment of the economics and effectiveness can be made.

Several methods of fume suppression have been tried in order to produce emissions which can be passed directly to air without the need to install arrestment plant. In the oxy-fuel process, oxygen and gas or oil are blown from concentric tubes on to the molten metal, the oxygen being in the centre. Fume suppression is achieved with satisfactory metallurgical properties for manufacture of plain carbon and low alloy steels, but the same success is not achieved with high alloy steels.

Another fumeless process of more recent origin is that developed by the Steel Castings Research and Trade Association (S.C.R.A.T.A.), whereby iron oxide, usually in the form of millscale, is injected into the molten metal by means of a patent dispenser. The full potentialities of this method have not yet been investigated but it seems as though its use might be extended beyond arc furnaces to open hearths and possibly other processes. Even though fumeless refining is achieved, there are other parts of the steel-making cycle which are unsatisfactory, *e.g.* melt-down and casting, which might need arrestment plant to satisfy public needs.

Foundry processes

The major emission problem of foundries is that of fumes from hot blast cupolas. The emission consists of wast gases containing carbon monoxide, sulphur dioxide, grit, dust, and fume as the significant pollutants. At times during the working cycle temperatures can reach over 1000°C. In 1958 when hot blast cupolas were scheduled under the Alkali Act, "provisional best practicable means" were set for the industry pending the working out of a satisfactory solution for fume arrestment. These provisional means consisted of simple methods of arrestment of grit and dust followed by dispersion of fumes at a suitable height depending on the local surroundings and the amount of production involved. Later, these requirements were stiffened according to "revised provisional best practicable means". These included a better collection efficiency, burning of the waste gases and a greater height of dispersal.

Several guinea pigs were chosen to try fume arrestment equipment such as electrical precipitators, bag filters, and Venturi scrubbers. There are many different ways of operating hot blast cupolas for metallurgical and other reasons, some of which favour one type of arrester and some favouring others. There have been failures and successes with all three types. One works installed an electrical precipitator at a cost of £120,000 but eventually scrapped it in favour of a bag plant. Finally, enough experience was gained to be able to make fume arrestment the requirements of "best practicable means". At the end of 1969, of the 96 hot blast cupolas in England and Wales, only 50 of which are operational at any one time, 18 were fitted with "provisional", 39 were using "revised provisional", and 29 were using full best practicable means. Operational difficulties are still being encountered, but there is no reason to believe that they will not be overcome with time and experience.

Electricity Works

In 1934 the Electricity Commissioners set the industry a standard of 0·4 grain per cubic foot (0·92 g/m^3) for emission of solid matter. Having regard to the limited knowledge on the suject at that time, which was reflected in the need for improved methods of testing and in the designs of dust arrestment plant then available, this standard presented a challenge which was difficult to meet and maintain. It became accepted as an international standard but in 1958, when electricity works became scheduled, the chief alkali inspector recognized that this standard was not good enough for modern social needs and he set a new standard for existing works of 0·2 grain per cubic foot (0·46 g/m^3). Examination of existing installed arresters showed them to be in poor condition and unable to meet even the old standard. Tests indicated an average emission of the order of 0·8 grain per cubic foot and a total mass emission for England and Wales stations of about one million tons per year or more. A massive programme of improvement was begun by the Central Electricity Generating Board which eventually cost them about £15 million. In some cases the problem was overcome by converting to oil burning, in others new arrestment plant was installed, while the remainder needed extensive maintenance. Today these stations are operating at around 0·2 grain per cubic foot or below. For the large new stations burning coal, dust arrestment in the form of electrical precipitators is designed to operate at 99·3 per cent efficiency, even after 12 months continuous operation; for coal with an average ash content of 20 per cent this amounts to an emission of solid matter of 0·04 grain per cubic foot (0·092 g/m^3). It is estimated that the 1969 emission of grit and dust from electricity works in England and Wales, burning 69 million tons of solid fuel, was of the order of 200,000 tons per year.

The largest power station at present being built in Britain is the 4,000 MW station at Drax, Yorkshire. At full load this station will burn nearly 40,000 tons of coal per day. It is estimated that about 1,200 tons of sulphur dioxide will be emitted each day and nearly 8,000 tons of ash will be presented to the electrical precipitators for arrestment. At an arrestment efficiency of 99·3 per cent

the mass emission of solid matter will be 56 tons per day—only 5 per cent of this has a significant free falling velocity so that only 2·8 tons per day are likely to "fall out" on the surrounding countryside. By emitting the gases from a single, multi-flue chimney, maximum advantage is taken of plume rise due to thermal buoyancy and momentum—about 2,000 feet above the chimney in average weather conditions—and with a chimney height of 850 feet we calculate that the effect of the waste gases at ground level will be negligible compared with the existing background pollution in this country, even in a rural area. The cost of the air pollution control equipment at Drax is around £5 million.

A significant advance in the control of grit and dust emissions from power stations is the development of continuous monitoring instruments.

Problems which are exercising the inspectorate's minds, but which cannot be described in this paper, are plume visibility, acid soot, and particle agglomeration.

Ceramic Works

When coal-fired bottle ovens in the pottery industry were scheduled in 1958 the movement towards their replacement by smokeless methods of firing in modern kilns using gas, electricity or light oil was well under way, as Table II shows. The inspectorate's "code of practice" requirements spurred the laggards and helped to complete the change more speedily than would otherwise have been possible.

TABLE II.—*Number of Operable, Coal-fired Bottle Ovens in Stoke-on-Trent Pottery Industry*

Number	Year
2000	Pre-1939
295	1958
222	1959
157	1960
95	1961
70	1962
30	1963
20	1964
11	1965
3	1966
—	1967

Progress with the prevention of smoke from intermittent kilns in the heavy clay industry is illustrated by Table III.

TABLE III.—*Improvements in the Firing of Kilns in the Heavy Clay Industry*

Year	Downdraught intermittent kilns				
	Coal, Hand fired	Coal, Mechanically fired	Producer-gas fired	Oil fired	Total
1961	2224	297	12	266	2799
1963	1895	312	1	448	2656
1965	1511	274	—	600	2385
1967	1134	231	—	678	2043
1969	657	158	—	619	1434

Production is now being conducted in the much less polluting and more easily controlled continuous or tunnel kilns.

In the saltglazing of earthenware, the glaze is produced by feeding common salt on to the fires during the last few hours of firing. The salt is volatilized and glazes the ware, being in effect a cheap way of coating the ware with sodium silicate. The emission is a dense fume of hydrochloric acid and mixed chlorides—strangely, potassium chloride predominates and probably results from replacement of potassium in the clay by sodium from the common salt. After careful examination by a working party consisting of representatives of the industry, its research association and the inspectorate it was concluded that the only practicable solution was to disperse the fumes from tall chimneys not less than 120 feet high. This was an encouragement to the industry to change to more modern methods of production and great pressure has been applied. In 1964 the industry was given until the end of 1970 to put its house in order by either (i) vitrifying the ware by heat, or (ii) glazing by means of applied glazes, or (iii) continuing traditional salt glazing and dispersing fume from tall chimneys. At the end of 1964 there were 860 intermittent kilns saltglazing of which 705 were using sub-standard chimneys. At the end of 1969, there were 396 kilns of which 232 were using sub-standard chimneys. There is intense activity in 1970 to meet our deadline and it remains to be seen how many do not succeed.

Blue Brick Kilns

A working party has been studying the black smoke problems from the blue brick industry for over 10 years. "Blue" bricks are first-class engineering bricks with outstanding properties of strength, acid resistance, and low porosity. For the last 24/48 hours of the firing cycle the kiln is operated under alternate reducing and oxidizing conditions to obtain the correct chemical and physical structure of the ingredients. During reduction, black smoke is made and so far we have not succeeded in finding a practicable solution to this problem. Partial success has been obtained with oil firing, and natural and liquefied petroleum gases are being tried. On the whole, a reduction of 50 per cent or so of smoke emission has been achieved but this still leaves waste gases which make a bowler hat look anaemic by comparison.

Perhaps our most intractable problem in the heavy clay industry is that of emissions from the production of Fletton bricks in the area between Bletchley and Peterborough, where over 40 per cent of the bricks made in Britain are manufactured. The threefold problem concerns emission of sulphur compounds, fluorides and an odour. Fletton bricks are made from Lower Oxford Clay, a deposit of the Jurassic system about 150 million years

old, which outcrops in a line running from Yorkshire to Dorset. The clay contains carbonaceous matter and has a calorific value of about 990 B.t.u./lb (550 calories per gramme). Total sulphur expressed as sulphur trioxides is 4 per cent and fluorine is within the range of 500 to 700 p.p.m. The kilns used for firing Flettons are all continuous and heat transfer between heating and cooling sections has been highly developed to give the most economic process possible. The emissions are usually from chimneys 150 to 250 feet high and are seen as fairly dense, whitish vapours drifting and settling downwind. They are unpleasant to smell and we have concluded that any waste gas treatment which is introduced and which fails to remove the smell has failed in its objective. It has long since been held that the visible plume was due to sulphur trioxide and a survey made 30/40 years ago seemed to show that about 90 per cent of the sulphur was burnt to SO_3 and the remainder SO_2. Using more modern methods, another survey indicated that only about 20 per cent was converted to SO_3, but very recent analyses using the new British Standard method give results of only 2 to 3 per cent as SO_3, which is equivalent to what is obtained in normal combustion of coal or oil. The effect of fluoride emission is to endanger the lives of cattle being reared in the area because of fluorosis obtained by eating grass contaminated by fluorides. Fluorides are both gaseous and particulate.

Many suggestions have been examined for treating the waste gases. The total volume of waste gases discharged to air from the industry is about 6½ million cubic feet per minute and the largest works has 37 chimneys. Water washing is out of the question as it would not only produce a liquid effluent disposal problem but also there is not sufficient water available in the area.

Waste gases from different parts of the firing cycle have been extracted and analysed to determine just where and at what temperatures the sulphur, fluoride and odours are emitted. Warren Spring Laboratory assisted in this determination with their more exotic instruments than those possessed by the inspectorate and the works. Gas chromatography was used to indicate the range of organic compounds involved and give a more precise assessment of the emission features. What we are seeking to do is to extract a relatively small volume of gases from those chambers which produce the pollutants in concentrated form and treat them separately from the main gas stream. There is a danger that the heat balance may be disturbed and methods are being sought to rectify this aspect. A new kiln is being built with an additional extract flue so that trials can be conducted. It will probably be many years before the problem is solved completely and possibly only then by means of tunnel kilns, which have been tried in the past without success. Meantime, trials with natural gas firing are being conducted although gas firing will not remove the main problems which emanate from the clay.

Gas and Coke Works

The gas and coke industry has undergone several revolutions in the past decade. It was based in the earlier days on the carbonisation of coal in horizontal retorts. Developments in carbonisation were represented by the use of continuous vertical retorts, chamber ovens and coke ovens. There were associated by-product plants and altogether gas works were always uncomfortable neighbours, with horizontal retort plants being the most intractable. At the beginning of the last decade oil began to be used as a feedstock, first heavy oil and later distillates, and the gas industry began to change to a petrochemical industry. A big step forward came with the ICI steam-naphtha process, the catalytic rich gas process, and the gas recycle hydrogenator. These new production processes were such that the space requirements were as

Eastern Gas Board Watford Works Horizontal Retorts Charging side

low as one-ninth and the capital requirements one-eighth of those applying to traditional carbonizing plant. They are relatively clean units but threw confusion into the smoke control programme by not producing as a by-product the solid smokeless fuel—coke—which plays a big part still in our smoke control efforts. However, no sooner had these new processes got into their stride when natural gas was discovered in the North-Sea, and a new revolution was upon us.

Table IV shows the gas-making position in England and Wales since vesting day in 1949.

TABLE IV.—*U.K. Gas Industry since 1949*

	Vesting day 1949	1958-59	1967-68	1968-69
Number of works operating	1050	463	192	170
Maximum daily capacity (million therms)	9·8	12·0	28·3	33·5
Gas available during year (million therms)	2661	2839	4638	5165
Coke sales (thousand tons)	—	9130	5532	4351

A survey in 1969 of all the existing plants in England and Wales revealed the position given in Table V compared with the previous year.

TABLE V.—*Gas Making Plants in U.K. in 1968 and 1969*

	1968	1969
Works using horizontal retorts	8	1
Works using vertical chambers	13	5
Works using continuous vertical retorts	56	35
Works using coke ovens	2	1
Works using carburetted water gas plants	74	50
Works using miscellaneous methods of gas making from coal or coke	2	1
Cyclic reforming plants using liquid feedstock	128	122
Continuous reforming plants using liquid feedstock	211	5

The Impact of New Technologies

Industry never stays still. Evolutions and revolutions are taking place all the time. There are many examples of new processes which have replaced more ancient methods, being themselves replaced in a few years or decades. The old Leblanc alkali process replaced the ancient method for extracting alkali from seaweed. It was the Leblanc process which caused the first Alkali Act to be passed, but this process was itself shortly to be replaced by the ammonia-soda process for making alkali. I have described the revolutions which have so altered the face of the gas industry. The same types of revolutions can be quoted for the chemical industry, the petroleum refining and petrochemical industries, iron and steel, electricity generation, etc. New technology frequently brings with it new problems but it gives a wonderful opportunity to get rid of old intractable pollution processes. The alkali inspectorate is in a peculiar position to keep a careful watch on these developments from the research and development stage, through the pilot stage, and finally to full commercial production. We are frequently consulted in the earliest stages and can often contribute usefully. A recent example is the erection of the two new primary aluminium smelters now being built in England and Wales and almost ready for commissioning. It is far easier and much less costly to incorporate air pollution control equipment at the design stage than to put it into a completed plant. In Britain, one of the first steps when air pollution problems are thought to exist is to consult the alkali inspector and I feel sure that all parties benefit.

Sulphur Dioxide

Sulphur dioxide is a special pollutant in that it presents a national rather than a local problem. There are local problems with some chemical plants, but I want to consider briefly the national situation.

Sulphur is a component of many solid and liquid fuels, which when burnt give rise to oxides of sulphur, usually about 2 to 3 per cent of the sulphur being converted to sulphur trioxide and the remainder to sulphur dioxide. Sulphur dioxide emissions reached a peak of 6·5 million tons in Britain in the period 1963 to 1965. In 1969 they had fallen to 6·1 million tons and predictions are that they will continue to fall to 5·9 million tons in 1970, 5·54 million in 1975 and 5·16 million in 1985. These assume that the average sulphur contents of fuels remain constant. In the last few years the average sulphur content of residual fuel oil has fallen from 3 per cent to 2·6 per cent and is expected to fall slightly lower. Moreover the ground level concentrations of sulphur dioxide have fallen by nearly 40 per cent during the last decade, partly by a changing fuel consumption practice and partly by the country's policy of dispersion from tall chimneys. One can argue the merits of the public health aspects of sulphur dioxide for a long time without reaching an agreed decision. Expert advice in this country is that there is no evidence of a significant public health hazard at the concentrations usually present in the atmosphere, even under adverse weather conditions. Recent investigational work seems to support this contention. Nonetheless, any pollutant is undesirable and if it can be removed practicably it should be removed. Dispersion can never be an alternative to prevention. Dispersion is only tolerated at present because no economically practicable method for desulphurization of fuel or removal of sulphur dioxide from gases has yet been developed. We are then left to treat sulphur dioxide pollution essentially as an amenity problem.

There seems no possibility of removing sulphur from solid fuel practicably, so we are left with liquid fuel desulphurization. It has been estimated that it would cost almost £1·50 per ton to reduce the sulphur content of residual fuel oil to a maximum of 1 per cent. This country consumes a little more than 30 million tons per year to reduce the quantity of sulphur dioxide liberated to the air by about one million tons per year. As residual fuel oil is mostly used on the larger industrial plants with waste gases emitted from tall chimneys, would the spending of so much money be justified by the improved effect at ground level?

Removal of sulphur dioxide from flue gases is an alternative, but the indications are that such would only be practicable for large sources such as power stations. The cost for British fuels would probably be of the order of 50p to £1 per ton of fuel, although one must not overlook the possibility of thereby using cheaper fuels of high sulphur content.

Recent developments with fluidized combustion of coal or oil in the presence of dolomite are promising in preventing emissions of sulphur dioxide. The sulphur is fixed in the bed of ash and/or dolomite. Extensive research and development are still being pursued and it may be that this method of sulphur dioxide control will eventually be one of the solutions we have all been seeking. We shall still be left with the numerous small and medium strength sources and the modern trend to use of natural gas, liquefied petroleum gas, and distillate fuels in these fields is welcome.

The Future

There is little doubt that the public is going to demand better and better standards of air pollution. This is technically possible but it is going to be costly and the public must be prepared to pay, for it is the public which pays in the long run. Preventing pollution is an international problem, for no country can afford to risk its international trade by progressing at a much faster pace than its rivals and thereby making its products uncompetitive. This country is participating in the international organizations tackling the problems of pollution. Pollution has different values in different countries. Those who are seeking to raise their standards of living from the relatively primitive are not going to burden themselves with the same social and amenity standards as the more advanced countries. To them, their priorities rightly belong to supplying work, better food, better health, and better living conditions.

This country has certain natural advantages in waste disposal over many other countries and it is right that we should use them. The setting of strict international standards for emissions and air quality criteria removes that flexibility of action which is so essential for each nation to decide its own policy. In this country I believe that our priorities are the continued reduction of particulate matter, with low level emissions the most important to tackle, motor vehicle exhausts, sulphur dioxide and odours.

Air pollution control is in the hands of local and central governments and when local authority reorganization is implemented there may be a shift of the present division of responsibility. International circumstances may also force us to revise our policies. Nearly 100 years ago George Davis helped Dr. Angus Smith to build an industrial air pollution control policy and he recognized the importance of coke in reducing smoke emissions. At the same time he was teaching himself the rudiments of chemical engineering. There have been enormous changes since those days, but the foundations which Davis laid are still firm.

TALL STACKS—HOW EFFECTIVE ARE THEY?

by

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Since the early days of industrial development flue gases from fuel burning and from other industrial processes, have traditionally been emitted to the atmosphere through chimney stacks, and allowed to disperse by natural diffusion processes. For many decades little thought was given to the design of chimneys beyond the strictly practical considerations of providing a suitable degree of natural draught to assist combustion, and keeping the costs to a minimum. In more recent years, the position has been very different. On the one hand, detailed scientific studies have led to more sophisticated designs of stacks, and a better quantitative knowledge of their performance. On the other hand the view is now frequently being expressed that tall stack dispersion does not compare at all favourably with ab initio measures to control chimney emissions, e.g. limitations on fuel type and quality, or flue gas treatment to remove pollutants before emission to the atmosphere.

Some of the criticisms that have been levelled at tall stacks are enumerated and discussed in the first part of the paper. In the second part some further aspects of tall stack emissions are examined.

The purpose of the paper is to define the conditions under which dispersion is a valid control measure and those where additional control measures may be necessary.

Part 1—Criticisms of Tall Stacks

The Reduction of "Total Pollution"

Of recent years the remark has commonly been made that while chimneys may or may not have certain merits they "do not reduce, in any manner, the total pollution added to the atmosphere". If total pollution means total emission then the statement is a truism and not worth making. If it does not mean total emission what meaning should be attached to "total pollution?" The most useful and sensible meaning to attach to it would be the total adverse effect produced on man and on vegetation and on the environment generally, by the emission of a pollutant. Let us take SO_2 as an example.

When SO_2 is emitted it diffuses into a very large volume of the atmosphere. The simple approach is merely to say that the only way to avoid atmospheric pollution is not to emit SO_2. Unfortunately this simple approach is so difficult technically and so expensive that we cannot hope to apply it within a generation. It is then surely sensible to ask which part of the volume affected is most important to man. Beyond question the answer is the part of the atmosphere within 10 or 20 metres of the ground. In this limited volume the effect of SO_2 on man is far more important than the effects 100 or 1000 or more metres above the ground although it is not suggested that these are non existent or completely negligible. They are of second priority. The current disagreement on methods of achieving clean air has occurred because we have not made the vitally important distinction between the atmosphere near the ground in which we live and breathe and the atmosphere generally. The essential feature of a chimney is that it has an immense influence on the state of the atmosphere near the ground rather than on the atmosphere as a whole.

Let us consider the effects which emissions have near ground level. These are probably 99·9% of the total effects on man! Let us consider total pollution in this sense and assess the impact of chimneys on it.

To evaluate total pollution by SO_2 at ground level in detail would require information about the distribution of sensitive and insensitive areas around a source of SO_2 and would be very difficult. However, a simple and conservative method would be to assume all the areas around the source were sensitive, or potentially sensitive. A number of different mathematical definitions of total pollution are conceivable as expressions of potential total effect on environment. The simplest of these assumes that the potential effect at any point is proportional to the concentration C at that point, is proportional to the time the concentration persists (t) and the overall effect is the summation of the effects at all the areas (A) affected by the plume. It is also sensible to postulate that there is some minimum concentration C min below which the adverse effects are negligible either because:

(1) They are smaller in magnitude that similar effects which occur in a state of nature anyhow, or
(2) Because they are so small that they are economically and biologically insignificant.
(3) Because below a certain concentration the effect of SO_2 may actually be neutral or beneficial rather than harmful.

The most obvious definition of total pollution is therefore $\alpha\int C da\, dt$ over all areas where $C > C_{min}$. The importance of time exposure is obvious and will be considered later in the paper. If for comparison purposes we take α as 1, we can say "total pollution per second" = $\int C da$ for all areas where $C > C_{min}$. The implication of this definition is that in each area affected by the plume we multiply the area by the particular concentration in that area and then sum the results for all the areas.

The computation has been carried out for flat countryside, for a wind speed of $5 ms^{-1}$ for a number of source strengths and for two alternative values of C min — $1000 \mu g m^{-3}$ and $100 \mu g m^{-3}$. The level of $1000 \mu g m^{-3}$ corresponds to reasonably good practice at present for a short term concentration; $100 \mu g m^{-3}$ is a much more stringent standard which is probably stricter than necessary. The result of these computations are shown in

Figure 1 and Figure 2 where total pollution for a particular source and wind speed is plotted against effective chimney height. They show that total pollution reduces extremely rapidly as the effective source height rises from ground level; and more slowly when the total pollution has been already reduced.

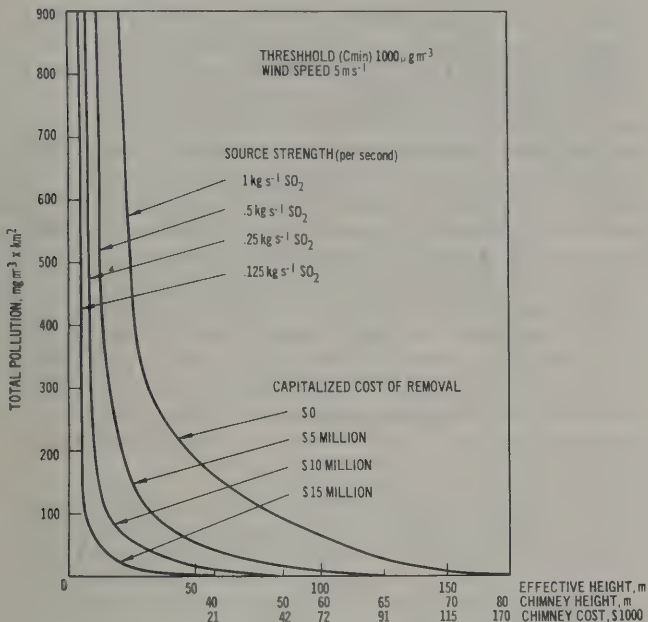

FIG.1 DEPENDENCE OF TOTAL POLLUTION ON SOURCE STRENGTH & CHIMNEY HEIGHT

Along the height axis of the figures is also scaled an estimate of the height and cost of a chimney for a typical power plant to provide the corresponding effective height making due allowance for the thermal rise of the plume. Against each of the source strength curves is shown an estimate of the total capitalised cost of reducing the largest source strength to the source strength quoted, by a removal process. These are merely order of magnitude guestimates and would need to be obtained ab initio for a practical case. The present analysis is an example of a method which makes it possible to make an assessment of the cost of achieving certain levels of total pollution. For example, if we wish for zero total pollution from a single isolated source of SO_2 the removal costs and the appropriate chimney costs can be taken from each of the curves in Figures 1 and 2 where they cross the zero line, and combined and plotted as in Figure 3.

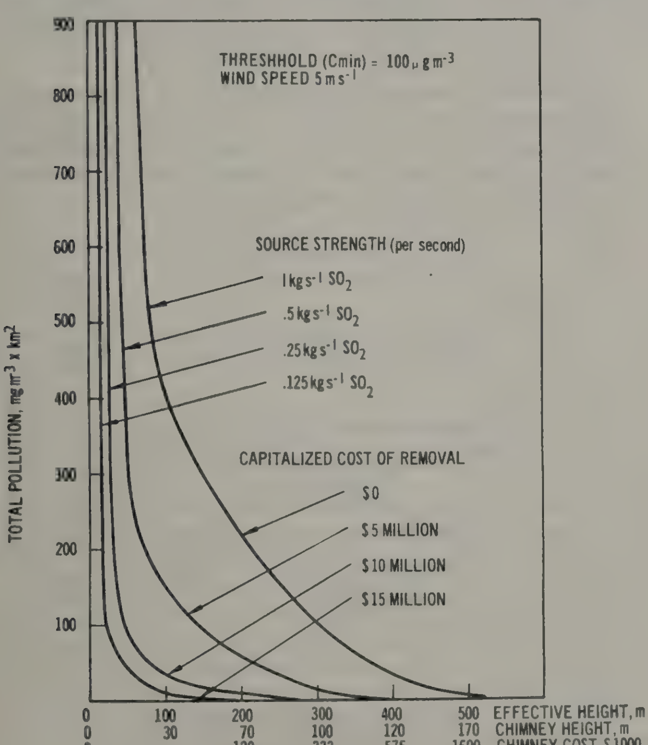

FIG.2 DEPENDENCE OF TOTAL POLLUTION ON SOURCE STRENGTH & CHIMNEY HEIGHT

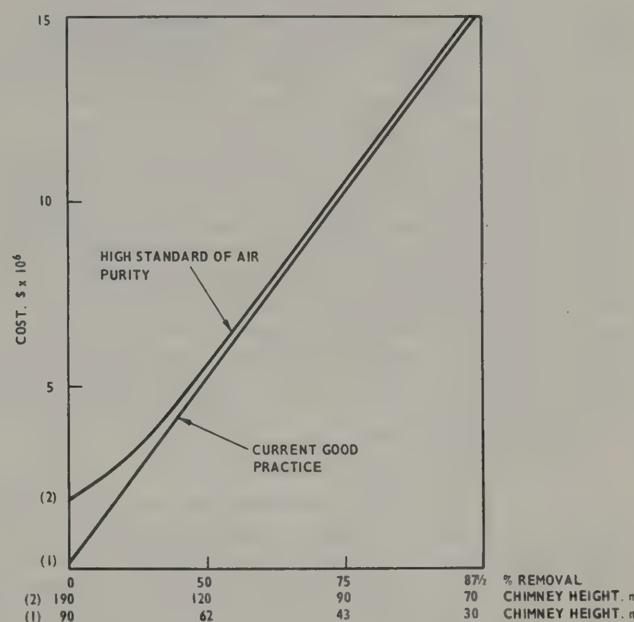

FIG. 3 TOTAL CAPITALIZED COST OF ZERO POLLUTION BY SO_2 FROM 1 kg s^{-1} SOURCE OF SO_2 USING DIFFERENT REMOVAL EFFICIENCIES AND CORRESPONDING CHIMNEY HEIGHTS

It can be deduced that:

(1) Total pollution will always be reduced by increasing chimney height.
(2) A chimney of reasonable height can reduce total pollution to zero, whereas a removal plant could only achieve this at 100% efficiency.
(3) In achieving a required reduction in total pollution, a removal process is likely to cost a great deal more than a chimney.

A similar analysis could be made comparing the relative costs of using tall chimneys and using low sulphur fuel. The result in most cases is likely to be similar—that chimneys will be more economic until they are extremely tall, but the economics will vary from case to case.

The reduction of emission either by a removal process or by using low sulphur fuel will not in general reduce emissions to zero. In either case therefore, we are merely concerned with reducing concentrations in the atmosphere. We need not consider accumulation over the years since SO_2 is relatively rapidly removed from the atmosphere.

A removal process or the use of a reduced sulphur fuel is not therefore different in principle from a chimney. Both reduce atmospheric concentrations.

In Figure 4 is plotted the ground level concentration along the axis of the plume for a source of SO_2.

(a) without removal and zero effective height
(b) with a million dollars spent on removal but zero effective height
(c) with a million dollars spent on a chimney with no removal and with zero thermal plume rise.
(d) the same as (c) with a normal plume rise.

To plot curves (a) and (b) in full the graph would need to be 300 times as high as it is!

The removal process reduces all concentrations at all distances by the same factor. The chimney reduces the highest ground level concentrations to zero, the middle range of concentrations by a large factor and low concentrations least. The latter is obviously preferable.

The analysis given above is an example of a method of using a sensible definition of "total pollution" which will be given in more detail in another paper. The method can also be applied to considering the effect of two sources and multiple sources. The method will show quantitatively that as two sources move close together the total pollution increases above a value of twice the single source. It will also show that a larger number of small sources, whose individual total pollution is zero, produce a large total pollution when they are associated in a town.

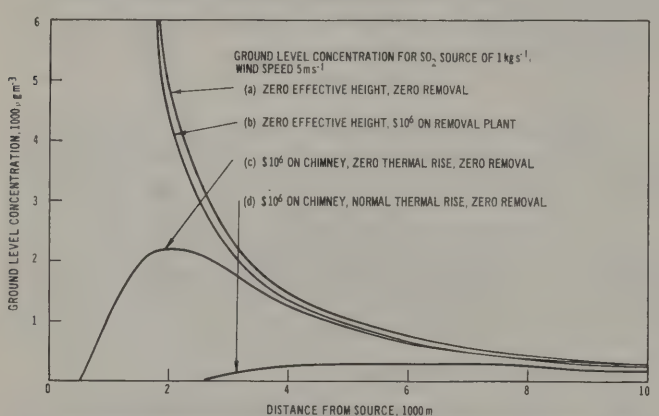

FIG 4 EFFECT ON GROUND LEVEL CONCENTRATION OF \$MILLION SPENT ON SO_2 REMOVAL, OR ON A CHIMNEY

The Areas Affected by Pollution

Tall stacks are sometimes criticised because they "only spread the pollution further afield". This implies that distant regions receive additional pollution so that nearer regions can be spared. If the pollutant is a gas which is not absorbed by the ground, the implication is false. A source with no chimney, i.e. curve (a) Fig. 4, will produce a certain pattern of ground level pollution with very high concentrations near the source and decreasing concentrations at greater distances. If a chimney is used, i.e. curve (d) Fig. 4, there is an area close to the source where the very high concentrations become zero, a middle region where the concentrations are reduced a little. There is no region where the concentrations are increased.

When the effective chimney height is increased by a factor, the same comments apply.

The above criticism is also false where the gas is absorbed by rain or cloud. Again there is no region where the ground level concentration are increased. In the case where the gas is absorbed at the ground (or where particulates are deposited) a situation can arise where a slight increase in concentration may occur at large distances with an increase in chimney height.

Pollution at Great Distances from the Source

A criticism is also made that "the height of emission becomes immaterial at long distances from the source". The implication is that over large areas all sources contribute to general pollution in proportion to their emissions.

That the implication is invalid can be demonstrated from practical measurements of SO_2 pollution in Britain. Figure 5 shows the trend over the years 1957 to 1968 of total SO_2 emission in the United Kingdom divided into three categories of source. The upper sector of the diagram shows emission from power stations, all of which can be taken as having tall, or reasonably tall, stacks. The middle sector includes all new sources of emission since 1957, from the combusion of heavy fuel oil; these emissions will mostly be controlled to satisfy the requirements of H.M. Alkali Inspectorate, and can thus be assumed to have tall or moderately tall, stacks. The lower sector includes all the remaining SO_2 emissions, principally from low level sources and including that from domestic heating. Also included on the Figure is a composite national trend curve of ground level SO_2 concentrations, which are smoothed average figures from measuring sites at many urban locations throughout the whole country[1].

If the criticism under discussion was valid, then over a geographical area the size of Britain it would be expected that the Figure would show average ground level SO_2 concentrations varying more or less directly with the total rates of SO_2 emissions, since most of the measuring sites will be remote from most of the sources of emission. In fact, it shows nothing of the kind. The decrease in ground level concentration bears much more relationship to the changes in low level emissions, and is consistent with the statement that under normal circumstances, most of the sulphur dioxide found near ground level has come from domestic heating.

Further independent confirmation of this conclusion is derived from a study of smoke/SO_2 ratios in the ambient air[1] which again ". . . shows that industry, on the average, makes only a very modest contribution to ground level concentrations of pollutants".

The balance between different sources of SO_2 emission in Britain may not be repeated in other countries, but this does not invalidate the inferences to be drawn from Figure 5. They must remain a most telling argument in favour of a tall stack emission policy.

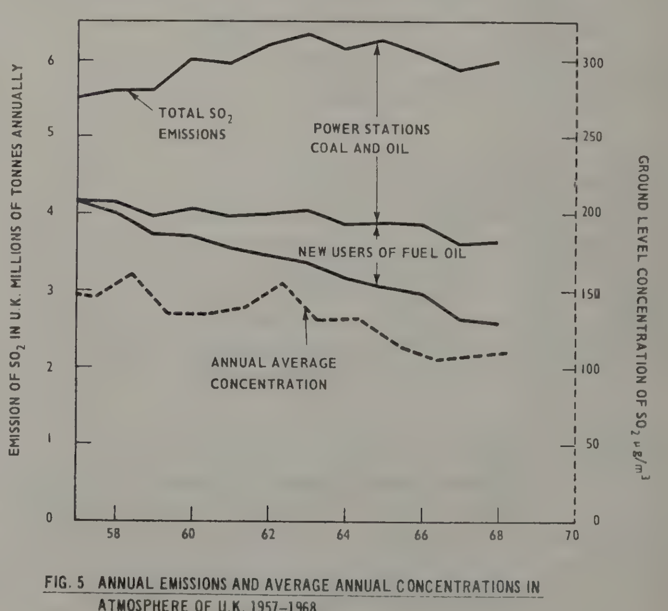

FIG. 5 ANNUAL EMISSIONS AND AVERAGE ANNUAL CONCENTRATIONS IN ATMOSPHERE OF U.K. 1957–1968

It is not the purpose of this paper to explore all the reasons for the significant reductions in ground level SO_2 concentrations in Britain in recent years, but it might usefully be stated that this has been achieved without restrictive legislation of any kind related to sulphur contents of fuels or to the quantity of SO_2 emitted from stacks.

Acid Rain at Great Distances

A recent claim is that "Sulphur Dioxide emissions from tall stacks can cause increases in rainfall sulphate and acidity up to many hundreds of miles away".

The difficulty in examining this criticism is the almost total lack of sound quantitative date on the fate of SO_2 in the atmosphere. From present knowledge it is not therefore possible to make a close estimate of the scale of the effect on distant rainfall. Estimates of industrial sulphate in rainfall are confused by the large contribution from sea spray at sites near the coast, but inland in Britain the annual rainfall sulphate is between 0·5 and 1 tonne km^{-2}. All attempts to estimate the rate of fall out of sulphate at distances of the order of 1,000 km. from a source lead to much smaller figures than the fall-out near the source.

Rather than speculate further on the relative contributions of low-level and high-level emissions on rainfall sulphate at large distances let us consider some other relevant points.

One factor to be considered is the effect of sulphate in rain. Agricultural land has a need for sulphur. Sulphur is not required at the same high rate as nitrogen, phosphorus or potash but it is an essential constituent of proteins and the minimum requirement varies from about 12 lb. (for hay) to 40 lb. (cabbage) per acre per year, with no allowance for loss by drainage. In terms of sulphate this is 4 to 13 tonnes km^{-2}. Annual dressings of sulphate in the form of superphosphate, sulphate of ammonia, or sulphate of potash at rates exceeding 20 tonnes km^{-2} have been applied to soil in Britain for many years without ill effects. This is in addition to an estimated absorption by soil and vegetation of SO_2 equivalent up to 10 or 15 tonnes km^{-2} of sulphate, and the 0·5 to 1 tonne km^{-2} in rainfall. Coastal sites receive much more. It will be appreciated that if farmers follow the current trend to non-sulphate fertilisers that the absorption of SO_2 by vegetation may not be described as pollution, but as supplying a fraction of the sulphur needs of the countryside. It is ideal to supply plant nutrients as small doses in rainfall. We conclude that, provided actually damaging concentrations of sulphur dioxide can be avoided, there is no better way of re-applying to the land the sulphur from the plants that formed the coal deposits than that of emitting it as SO_2 from a high chimney.

Although sulphate in rain may be beneficial, acidity is unwelcome. Pure rain, in equilibrium with carbon-dioxide, would have a pH of 5·6 and 25 micro-equivalents of acid per litre. If the CO_2 is displaced by SO_2, oxidized to H_2SO_4, rain with the same total acidity would have a pH of 4·5. Since 1962 the rain in parts of Sweden has become more acid than this, and have given cause for concern. There has been no upward trend in their figures of sulphate in rain since 1961, although the average from 1961 onwards is higher than that from 1956 to 1960. The increase in sulphate cannot alone account for the decrease in pH, and we can possibly look to a decrease in alkaline substances to explain the latter. This could occur through a change in weather patterns or a change in the consumption of fuel oil relative to coal, both of which are known to have occurred over the last decade throughout Europe.

Theoretical Calculations

There is often a feeling among conservationists that the truth about diffusion from tall stacks is concealed from the layman by the complication of the mathematics.

The plant designer also faced with the task of predicting the likely effect of a new source of emission, is seldom in a position to reach a balanced view on the applicability of the various theoretical treatments available to him. There is a need for a simple method of calculation which will give him the information he requires in a form that can easily be comprehended by non-experts; particularly, perhaps, by any lay persons who may need to be re-assured about the effect of emissions from a proposed plant.

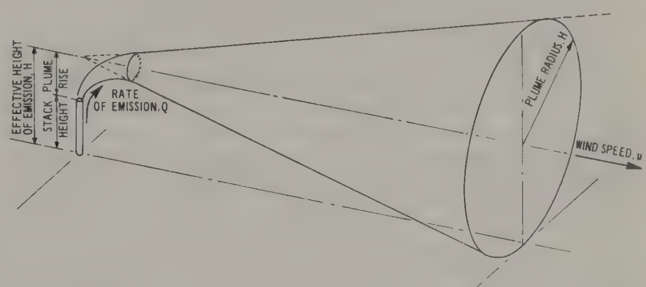

FIG 6 SIMPLE CONE MODEL OF PLUME DISPERSION

To explore this approach, the simplest geometrical model of plume diffusion from a hot source is shown in Figure 6. A cross-section of the plume is drawn where the lower edge first touches the ground and, hence, where the plume radius is equal to the effective height of emission, H. If the wind speed is u ms^{-1} the air flow through the cross-section will be $\pi H^2 u$ m^3 s^{-1}. This air flow will contain all the pollutant emitted from the source, say, Q m$_3$ s^{-1}. The average volumetric concentration of pollutant over the cross-section is then:

$$\frac{Q \times 10^6}{\pi H^2 u} \text{ p.p.m.} \qquad \ldots\ldots\ldots\ldots (1)$$

It will be noted that this expression, derived solely by elementary geometry, differs from the well-known Sutton equation for maximum ground level concentration only by the omission of a numerical factor of 2/e, or 0.735 which arises from Sutton's assumption of a Gaussian distibution of pollutant about the horizontal axis of the plume, instead of the uniform distribution in the conical model. Provided it is understood that the aim of Equation 1 is to produce a simple index of stack performance which can be related to practical measurement in the field, then this small numerical difference is unimportant.

Figure 6 and Equation (1) can be taken to represent the "instantaneous", "peak", or "short-term average", conditions, where the sampling time is of the order of a few minutes. In Figure 7 the behaviour of the same conical plume is represented over a long period of time during which the wind might blow from any compass direction. An experimental finding is now added in that the maximum ground level concentration under average wind conditions (about 7 ms^{-1}/sec. in Britain), occurs at a distance from the source of about 15H. To a close approximation, the cross-section of the plume thus occupies any position on the surface of a cylinder of 15H radius and 2H height. The ratio of the plume cross-sectional area to the area of the cylinder is then:

$$\frac{\pi H^2}{2 \times 15 \pi H \times 2H} = 1/60$$

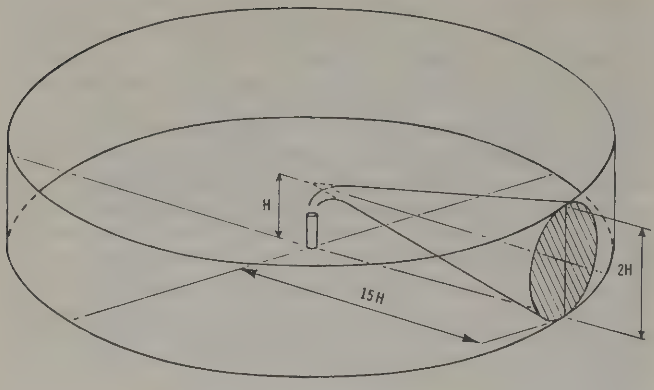

FIG. 7 LONG-TERM AVERAGE MODEL OF PLUME DISPERSION

The mean long-term average concentration from the plume at this radius can thus be expected to be about $1/60^{th}$ of the short-term peak concentration, and this is a good approximation to the long-term average ground level concentration immediately downwind of where the plume first touches the ground.

These results are confirmed by published data on air pollution surveys around large station sources in Britain[3] [4]. Modifying a Table published by Catchpole[5] to allow for the more simple diffusion model described above, yields the following Table of multiplying factors in which P is the calculated short-term peak concentration obtained from Equation 1.

TABLE 1
Dependence of Concentration on Sampling Time Measured Results

Sampling Period	*Mean Value of Observed* Concentrations*	*Normal Maximum Concentrations*	*Highest Recorded Concentration*
Short-term Peak (e.g. three-minute average)	$\frac{P}{7}$	P	2P
One Hour	$\frac{P}{18}$	$\frac{P}{2}$	P
One Day	$\frac{P}{80}$	$\frac{P}{10}$	$\frac{P}{4}$
One Month	$\frac{P}{320}$	$\frac{P}{60}$	$\frac{P}{40}$

* In plume affected area at the distance of maximum concentration

The "Mean Value of Observed Concentrations" given in the second column of the Table represents the mean of a large number of readings at a fixed point down wind of the source and thus includes the "averaging effect" of small meanderings of the plume about its time-average centreline. These figures are, therefore, a correct measure of the concentrations to which a person or object would normally be subjected, if he is in the plume area. The column headed "Normal Maximum Concentration" represents the levels of concentration recorded under exceptionally steady conditions, when the axis of the plume is directly over the measuring point for a major part of the sampling period, and the wind speed is the most favourable; these are the highest concentrations likely to be encountered for 98 per cent to 99 per cent of the total time. The final column of the Table represents the highest readings recorded in practice under the full range of weather conditions encountered during field studies lasting several years.

In summary therefore, the simple and easily understood calculation of short-term peak concentrations given in Equation 1 produces a figure which is not exceeded in practice for more than 1 per cent or 2 per cent of the time, and is never exceeded by more than a factor or two. The mean of the short-term peak concentrations at a fixed point downwind of the stack is furthermore only one-seventh of this figure. On the basis of daily average measurements of concentration (which are standard in Britain for the National Survey of Air Pollution) the maximum effect from a tall stack would only infrequently exceed one-tenth of the calculated peak concentration and would never exceed one-quarter of it. The mean daily concentration at a fixed point is only one-eightieth of the calculated peak concentration and in practice is usually too small to be detectable with normal instruments.

The simplicity of the above approach to emission calculations is born, not of naivety, but of sophistication, since it relies heavily on the confidence built up over two decades of research investigations, theoretical studies and, above all, field measurements at upwards of 80 different power stations. The range of variation in the expected ground level concentrations arising from tall stacks is definable and it is well within the capacity of a competent engineer to allow for this variation when reaching a decision on the required height of a new stack.

Special Weather Conditions

It is sometimes said that "high ground level concentrations of pollutants can still be expected from tall stacks under certain adverse weather conditions".

This type of criticism of tall stacks frequently arises from mathematical calculations which purport to show greatly increased concentrations under specified meteorological conditions. These may include:

"plume looping" during periods of superadiabatic lapse rates,
"fumigation" during periods of break-up of low level inversions,
"limited mixing depth" during periods of elevated inversion layer.

Emission calculations obviously have an important part of play in all considerations of stack height and emission control. There is nevertheless, a regrettable tendency to let the "tail wag the dog". Where field experiments have failed to demonstrate the adverse effects predicted by a favoured theory, then all too often it is the experiments that are criticised as being "inadequate" or "biased" and the theory tenaciously upheld, perhaps as a justification for extreme regulatory action.

With tall stacks in open country, the "fumigation" situation following the break-up of a low lovel inversion just does not appear to produce increased ground level concentrations, despite these having been observed with much smaller sources; a fact already noted by Maynard Smith[6]. It should perhaps be noted here to avoid confusion that the Trail Smelter situation was, of course, a special case where the inversion and the plume were confined in a deep valley and the flue-gases were thus prevented from dispersing laterally as well as vertically.

The "plume-looping" situation has been found[7] to give the highest measured peak concentrations in prac-

tice but, in terms of the simplified and slightly pessimistic Equation 1 they are observed not to exceed the value of 2P given in Table 1. In this special case, the peak concentrations can occur much closer to the source than normally.

The "limited mixing depth" situation implies an inversion layer at some height above the surface which prevents upward dispersion, so that flue-gases are trapped between the inversion and the ground. It has been shown both theoretically[8] and practically[9] that, at worst, this situation would double the ground level concentrations occurring in a neutral atmosphere, as indicated in Table 1.

In Britain at least, the last two cases only infrequently and both are very transitory. Several years of continuous measurements have been necessary to produce a handful of examples of each type of plume behaviour. It would be unwise to assume that they occur elsewhere with much greater frequency until definite proof had been obtained. The conclusion to be drawn is that the dire prediction of harmful effects from tall stacks just do not occur in practice.

We have not listed periods of low level inversion of the sort which caused the London incident in 1952 and others equally well known since it was established[10] and is now well recognised that plumes from tall chimneys penetrate the low level inversion either partially or completely and do not contribute to the abnormal ground level concentrations.

Special Topographical Conditions

It has been stated that "tall stacks are ineffective in hilly country".

Local topography will clearly have a marked influence on the utility of tall stacks. The effects of high ground are not always obvious, and the mental picture commonly held by the layman, of a chimney plume travelling horizontally until it hits a rising hillside, is of course quite false, since the general air-stream carrying the plume must be deflected up or around the higher ground.

The situations where difficulties can occur are discussed in the technical literature[11] and can be summarized as follows:

(a) High ground upwind of the stack causing downdraughts, waves or eddies which may bring parts of the plume prematurely to ground level.
(b) Similar eddies in the lee of high ground downwind of the stack which may cause higher concentrations on the reverse slope than would normally be expected at that distance from the source.
(c) Special meteoroligcal features of sloping ground, such as katabatic winds and closed valley circulations, which may also cause chimney plumes to descend prematurely.
(d) Inversion layers below the level of the surrounding hills which may trap pollutants in a limited volume of air at the valley bottom. (The Trail Smelter case has already been mentioned; the well-known Donora Valley and Meuse Valley pollution incidents had a similar origin). The "fumigation" caused by subsequent break-up of such inversions may also be serious in these confined situations.
(e) The "channelling" effect of valleys on wind direction, which may tend to increase time-average concentrations up and down the valley, whilst decreasing them in other directions.

It will be obvious that a general criticism of tall stacks on the above grounds is not really justified since the problem is mainly one of scale. Clifty Creek and Cardinal power plants in the U.S.A. are cases where careful selection of stack height has overcome the problems of difficult terrain[12] and there will be many similar cases elsewhere. It can always be said that the taller the stack the less likely the occurrence of adverse effects as listed above. However, a point must be reached when considering really high ground where a stack sufficiently tall to avoid topographical effects is no longer technically feasible.

Each topographical situation is unique and it is thus difficult to generalise. A rough "rule-of-thumb" found effective in Britain is that problems are unlikely to arise, provided that the ground does not rise higher than the stack top within a radius of about 2 km., and provided also that the change in level is reasonably gentle and not abrupt.

Where more adverse situations occur, a wind tunnel test is normally made. Whilst these tests still have limitations, great advances have been made in recent years in the simulation of the atmospheric boundary layer[13] and the behaviour of buoyant plumes. The large low-speed wind tunnel of the Central Electricity Generating Board at Marchwood is, for instance, currently being used for tests on a topographical model which represents 130 square kilometres of territory at a scale of 1:1,000. For these tests a simulated boundary layer with scaled wind velocity and turbulence profiles is being incorporated, together with a buoyant plume. As in previous topographical tests, prior measurements will be made on a flat control surface to compare with similar tests made on the full model. The objective of the tests is to determine the stack height required in difficult terrain, such that the ground level concentrations do not exceed those that would be produced by a similar plant on a level site with a stack of normal height. By keeping the tests comparative in this way, some of the limitations of wind tunnel tests can be minimized.

With techniques of this kind, much can be done today to design stacks which will avoid topographical problems. There will always remain cases where the tall stack solution may not alone be adequate to prevent unacceptable concentrations from occurring in one or more of the above situations.

High Sulphur Fuels

It has been said that "tall stacks cannot deal with high sulphur fuels".

As in the preceding case, this is really a matter of degree, and not of kind. In most practical instances, the ground level concentrations of SO_2 produced by a fuel-burning installation will vary directly with the sulphur content of the fuel, so that the problem becomes one of selecting the appropriate effective height of emission in order to maintain concentrations within a desired level. However, the effective height of emission is the sum of the actual stack height plus the plume rise due to buoyancy and efflux velocity; in the case of a large plant, the latter is often much greater than the former and will not vary significantly with the sulphur content of the fuel being burned. Increases in effective height of emission must, therefore, be accomplished mainly by increasing the stack height itself and this may lead to excessively tall stacks in certain cases.

As an example, the figures in Table 2 have been calculated for a 2,000 MW single-stack power station burning coal of various sulphur contents. A wind velocity of 7m s^{-1} has been assumed and the plume rise has been calculated by means of a formula derived from practical observation of power station plumes in Britain[14] (see Section 11). (In this formula, plume rise is itself partially dependent on the height of the stack).

TABLE 2
Stack Heights Required to Give a Constant Ground Level Concentration of SO_2 with Varying Sulphur Content of Coal for 2000 MW power station

Sulphur content of coal—%	*Required effective height of emission metres*	*Plume rise metres*	*Required stack height metres*
2	550	350	200 (Datum)
3	675	425	260
4	775	460	315
5	865	505	360

It will be seen from Table 2 that the required stack height increases considerably with increase in sulphur content. Whilst stacks of up to 350 metres height have, in fact, been built for larger power plants, these have generally included some allowance for adverse local topography. It must also be emphasised that the use of two or more stacks for the same total capacity of plant would require a further increase in all the stack heights shown in the Table, if the same ground level concentration was not to be exceeded.

It cannot be concluded that stack heights have yet reached a limit but, for very large plants burning high sulphur fuels, the situation must be near where some other means of limiting ground level concentrations may become economically or technically attractive.

The Threat to Aircraft

In certain areas it is claimed that "tall stacks are a hazard to air navigation". This criticism is, of course, true of stacks as it is of all tall structures. In practical terms, difficulties are usually encountered only in the vicinity of airports, where regulations to limit structure heights are in force. Standard restrictions on building heights near to major national airports are laid down by the International Civil Aviation Organization and can impose a severe limitation on stack heights for many kilometres around.

These height restrictions are not normally regarded by the aviation authorities as being open to negotiation. If they were, the question would be one of a balance of risk—on the one hand, the remote but catastrophic risk of collision by an aircraft, and on the other hand the continuous risk to amenity by emission from a lower than desirable stack. In special cases with smaller airports, it has occasionally been possible in Britain to reach agreement on the abandonment of a particular runway in order to permit the construction of a tall stack, and in one particular instance, a power station was built initially with short stacks where it was known that the airfield in question was to be abandoned or modified later. The stacks were designed to be capable of a later increase in height and when this was undertaken, the opportunity was used to make field surveys of pollution levels before and after to record the benefit of the increased height [15] [16].

In most cases, however, the height restrictions will be regarded as inviolate, and the problem then facing the plant designer becomes one of economics. The choices available to him will include that of abandoning the proposed site for one where the height restrictions do not apply. If this is not acceptable then the choices available on the original site must be tailored to suit whatever stack height is permitted by the safeguarding regulations. These include:

(a) A restriction on the output of the plant.
(b) A restriction on the quality of the fuel.
(c) The installation of equipment to remove pollutants before emission.

In regard to (b) and (c) it must be stressed that it would be unwise to restrict attention solely to sulphur dioxide emissions. Away from airports the height of aircraft flight is much higher than any conceivable chimney for several good reasons. The problem is therefore of limited interest.

Appearance of Stacks

It is often claimed that "tall stacks are unsightly". Whilst some people admit to finding tall stacks attractive to the eye, it cannot possible be claimed that the majority of the population shares this view. The mental association of chimneys with the disposal of wastes is a strong one, and cannot be changed merely by better architectural treatment of stacks to make them more aesthetically satisfying. The stubborn fact remains that a tall chimney on the landscape always attracts more than its fair share of blame and disapproval.

At the other extreme, architects designing non-industrial buildings sometimes go to considerable lengths to conceal the fact that the building needs a heating plant, and the heating plant a chimney (presumably in the belief that the general public do not wish to be reminded of such mundane necessities). It is not difficult to find examples where this practice has itself created an air pollution problem; either to the inhabitants of the building concerned, or to those living nearby.

The aesthetic standards of the general populace are thus in direct conflict with good technical practice. It is possible that if the public were made more aware of the technical facts then their standards might change over the course of time, to the benefit of air pollution control. An analogy can perhaps be found in the design of electronic consumer goods, which are accepted today in a true "instrument finish" whereas a few years ago it was necessary to disguise them inefficiently as pieces of furniture. Moreover, the objection is more often to the visible plume than to the chimney itself. If all plant emission standards on smoke and dust were brought up to the best current practice the objection would undoubtedly decrease.

The problem then, is simply one of education, and the reduction of plume visibility, but it would be beyond the scope of this paper to discuss how these can be achieved.

Part II—Further Aspects of Emissions from Tall Stacks

The Importance of the Buoyant Plume

Twenty years ago there was very limited recognition for the fact that the hot plumes emitted from tall chimneys rose to a considerable height above the chimney top. At the present time there is universal recognition of the importance of the thermal rise but considerable

disagreement as to the actual value to be placed on the rise under given conditions. The main reasons for the disagreement is probably that the plume rise has been measured by different investigators at varying distances from the stack. It was pointed out in 1963[17] that the plume continues to rise for considerable distances and in general it may be said that for chimneys 100 metres tall and greater it is necessary to measure the plume rise at about 1,500 metres from the stack or if the measurement is made nearer to the stack to apply the appropriate extrapolation to get the correct plume rise.

Photographs tend to give misleading data partly because the plume often disappears at shorter distances than 1,500 metres, partly because the upper edge of the plume tends to behave differently from the lower edge of the plume, both aerodynamically and in respect of photographic contrast and also because there can be unexpected geometric errors which do not apply to methods using the "height-range" method with sensitive detection, such as the Lidar method[18]. There can be little doubt that effective plume heights are greater than many investigators have reported and it is now considered[14] for a plume which is properly launched into a neutral atmosphere at a height greater than $2\frac{1}{2}$ times the building height, the thermal rise is given by the expression $ht = (8{\cdot}55 + {\cdot}06hc)\,Q/U^{1/4}$

where ht is the thermal rise in metres
hc is the chimney height in metres
Q is the heat emission in watts
and U is the wind speed in ms^{-1}

This expression probably applies over the range of chimney height from 30 metres to at least 200 metres and is based on data from 60 m. to 125 m. There is no reliable information about plume rise for the numerous chimneys of height less than 30 metres which together cause most of the ground level pollution.

What are acceptable levels for SO_2?

It has been explained that the dispersion of sulphur from fossil fuels in the form of sulphur dioxide from high stacks is of benefit to vegetation and thus to the community as a whole. What has to be avoided is concentrations that are actually damaging. It is pertinent to examine what these damaging limits are.

As far as human health is concerned, evidence of the ill effects of SO_2 has been extraordinarily difficult to come by. There is a well documented effect of smoke accompanied by SO_2, and this is examined in the paper to this Congress by Lawther and Bonnell[19]. The evidence on damage to health in connection with SO_2 alone is largely negative. There is the well-known health record of the workers at the Abadan Refinery, where the atmosphere was dry but the SO_2 was for long periods in the range up to 25 p.p.m. (71,500 $\mu gm.^{-3}$)[20]. The Hazleton Laboratories[21] have kept monkeys in atmospheres containing more than 1 p.p.m. (2,800 $\mu gm.^{-3}$) of SO_2 for several months with no adverse effects. It seems that amenity is a more stringent criterion than health for primates, and perhaps most animals. This would imply that the gas alone is not harmful below the concentration at which it can be detected by smell.

Vegetation would appear to set a lower limit for an acceptable concentration than animal life. Fungi are particularly sensitive to SO_2, and the gas has long been used for the fumigation of greenhouses, although at much higher concentrations than are observed in the atmosphere. Its effect on fungi and bacteria may partly explain the robust health of animals exposed to it. The higher plants are more tolerant than the fungi, but species, and even varieties of the same species, differ in their sensitivity. Sensitivity also varies with the season and with the weather. A substantial amount of research has been done on the effect of SO_2 on plants. All results indicate that, as with most injurious substances, the effect is proportional to concentration multiplied by time of exposure, that is, to Ct. But since a low concentration is not harmful (and may actually be beneficial) a threshold value, which also varies with species, has to be subtracted from C. Estimates of this long-term threshold value vary from 670 $\mu gm.^{-3}$ to the low value of 420 $\mu gm.^{-3}$ deduced from the most recent work in this field, by Dreisinger and McGovern[22]. Their principal findings are summarized in the following table.

TABLE 3
Tolerable values of (C—400)t in μgm^{-3} h

	Growing period, moist weather	*Cold, dry*
Sensitive species	1700	4500
More resistant	2300—3400	6500—11,000

It is possible to compare the "just safe doses with the doses which occur in practice by plotting the maximum concentrations which are experienced against the averaging times used. This is done in Figure 8 for the concentrations around a large power station for which P in Table 1 would be 0·5 p.p.m. (1,400 $\mu gm.^{-3}$). This may be regarded as a limiting case and would correspond, for example, to a 4,000 MW power plant burning fuel oil of 3 per cent sulphur content and emitting gases

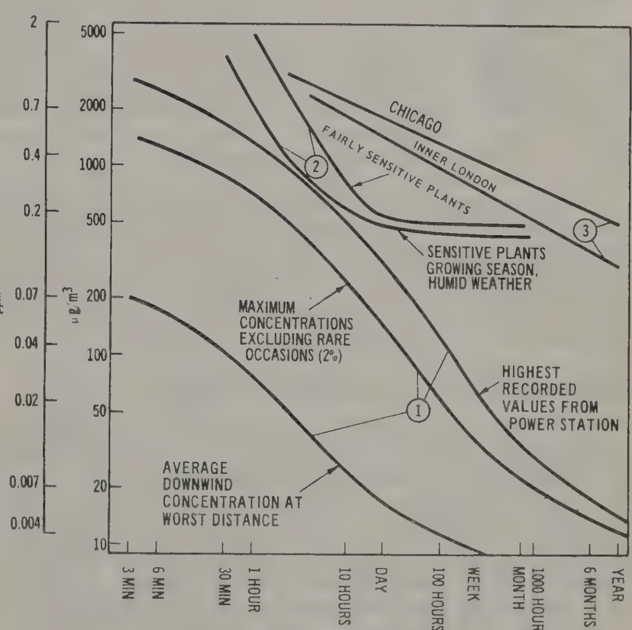

FIG. 8 DEPENDENCE ON SAMPLING TIME OF
(1) MAXIMUM CONCENTRATIONS FROM A LARGE POWER STATION
(2) CONCENTRATIONS WHICH AFFECT VEGETATION
(3) MAXIMUM CONCENTRATIONS IN CITIES

through a single stack 240 m. high. New power plants designed in Britain over the last decade have not exceeded this value of P. The lines for the concentrations in two cities are plotted. The Dreisinger and McGovern findings for plants are also shown, and it is of interest that the less sensitive line coincides closely with the findings of European workers in this field. It will be seen that 400 $\mu gm.^{-3}$ can be maintained indefinitely, but that 1,000 $\mu gm.^{-3}$ is only safe for three hours for the most sensitive species in the growing season.

The interesting deduction from this chart is that it is neither the short-term (less than 30 minutes) nor the longer term (more than one day) power station effects which are closest to the possibilities of damage, but those lasting for a matter of a few hours.

For all but 2 per cent of the time a modern power station shows a wide margin of safety as far as potential damage to vegetation is concerned. Only the highest recorded concentration over periods of two to eight hours are approaching significance and then only if they coincide with humid conditions in the growing season. Plume looping has been quoted as causing some of the highest levels recorded. These are invariably short-term concentrations. Plume looping is not therefore the most critical situation for a source with a tall stack.

How Important is Sulphur Dioxide?

Nearly all computations of chimney height are based on sulphur dioxide as the pollutant. This is probably satisfactory and there is no evidence that if a chimney is sufficiently tall to give satisfactory ground level concentrations of sulphur dioxide, that there is any other gaseous pollutant in normal furnace flue gases which is not also satisfactorily diluted. However, if sulphur dioxide concentrations in flue gas effluents are reduced either by using low sulphur fuels or by sulphur removal processes, unless all pollutants are reduced in the same ratio, there is no body of experience which will establish the appropriate chimney height for these other pollutants.

The advantages to be gained from sulphur removal may possibly therefore, be limited until we have further information on the dilution required by other pollutants present in flue gas. Experience in Britain where gas washing has been employed has demonstrated that the public do not cease to object to flue gases even when 90 per cent of the SO_2 has been removed.

The gas washing installation at Battersea B power station in London has recently stopped operation for a two-year experimental period. It is expected that the increased thermal rise of the plume will be more effective than the gas washing plant in reducing total pollution.

What measures can supplement a chimney?

In all cases, good design of a commercial or industrial installation will include a chimney as high as is needed for adequate dispersion. If the necessary height is not practicable, additional measures must be applied. The appropriate additional measures will depend upon the circumstances. In general, for small sources such as heated buildings and motor vehicles, where the total pollution results from the sum of many similar sources, the proper control measure is the use of a pollution-free heat source or a fuel and a combustion process which produce gases containing little other than nitrogen, carbon dioxide and water vapour. The latter means very low sulphur fuel and very efficient combustion.

For large plants the general use of low sulphur fuels is unnecessary and undesirable. The limited supplies of such fuels should be reserved mainly for small plants with low chimneys. Nevertheless, there will be circumstances with large plants where the highest practicable chimney is not adequate at all times. It is clear from Figure 8 that high short-term concentrations are not critical; nor are the long-term effects. Monthly figures 10 times as great as those shown do not appear to have adverse effects. But reduction may be required during those weather conditions which give rise to high SO_2 concentrations for periods of two to eight hours. The measures available for achieving some reduction of ground level concentrations for such periods of time include:

(a) simple reduction of plant output,
(b) increase of exit gas temperature, which increases Q in equation (Sect. 12) and thus increases the effective height,
(c) use of fuel of lower sulphur content for the critical period,
(d) a method of extracting some of the SO_2 from the flue gases which has a low installation cost, which can be operated for short periods only, and which does not cool the gases.

The choice of measure will depend upon economics and technology.

Much research has gone into the removal of pyrites from coal. However, ordinary coal washing will remove some pyrites, and if this is not enough, some of the remainder can probably be removed by a procedure integrated with the process of pulverisation, and this will give a further 20 per cent reduction for all the coal or allowance for loss by drainage. In terms of sulphate reduction.

There are usually insuperable difficulties in changing the coal supply to a large furnace at short notice, but given a few hours warning the procedure is practicable with some types of combustion equipment. With oil-fired plants it is technically easier to switch to a lower sulphur fuel at short notice, or to mix some low-sulphur oil into the feed, and the use during a year or, say, 5 per cent of low-sulphur oil to supplement a normal 3½ per cent supply should not be unduly costly. Where the main fuel oil supply can be kept to 3 per cent sulphur or below almost every large plant should be able to keep within the bounds of Figure 8 without supplementary measures. Natural gas, if available at an acceptable cost, is normally the favoured fuel for supplementary firing at either coal or oil-fired plants, and can be employed with the least technical difficulty.

Sulphur dioxide extraction processes are not promising. One process that might qualify is dry lime injection, aimed at about 20 per cent reduction and engineered for occasional use. Processes which simultaneously cool the gases tend to defeat their own object because of the loss of thermal buoyancy. Most SO_2 removal processes under investigation would be highly expensive or technically unsuitable for intermittent operation, and the justification for further development is questionable.

A pollutant for which the high stack alone is not effective is particulate matter, which with coal-firing may in amount be an order of magnitude greater than the SO_2 emitted. If the dust is coarse or aggregated it may cause a more intense, more localised problem than a gaseous pollutant. It cannot be too strongly stated that nothing less than the best practicable means must be employed for avoiding the formation of smoke and for extracting dust out of industrial waste gases. Both constitute pollution which has a high nuisance value but which is readily avoidable with available technology. The subject of efficient electrostatic precipitation is, however, dealt with in a companion paper to this Congress[23]. It is well known that methods which reduce smoke emission usually pay for themselves as well as suppressing a noxious and offensive pollutant.

Pollutants for which high stacks are effective

To quote H.M. Alkali Inspector: "There are no such things as toxic gases, only harmful concentrations". Even oxygen becomes harmful as its concentration rises from 21 per cent to 100 per cent. High stack dispersal is thus effective for the dilution of any gaseous pollutant which does not accumulate in the atmosphere. Most of this paper has been concerned with sulphur dioxide, which is quantitatively the most important. Next in importance are nitrogen oxides and hydrogen chloride. Nitrogen oxides are, like SO_2, a natural constituent of the air, and combined nitrogen is even more important than sulphur for vegetation. High concentrations of nitrogen oxides are, however, undesirable because of the photochemical reaction with the products of the inefficient combustion of hydrocarbons in vehicles. The flue gas content of NO_x can be minimised by avoiding high combustion temperatures, but the tall stack is effective in dispersing the remainder high in the atmosphere. Hydrogen chloride, which results from the combustion of coal containing salt, is quite harmless when sufficiently diluted.

It must be emphasised that pollution is a local problem. As one passes from the urban areas where the highest concentrations at breathing level are produced, the gas diffuses upwards and is also absorbed at the ground. So the concentration near the ground steadily falls unless it is added to by local sources. If the local problems were solved (by burning low-sulphur fuel in cities and by tall stacks for large sources) there would be no national problem.

Conclusions

A high chimney is a cheap, reliable and indeed indispensible means of reducing pollution by gases. The criticism of chimneys is largely misguided. The critics tend to consider the atmosphere as a whole and do not consider in sufficient detail the small part of the atmosphere in which we live and breathe. It would be a tragedy for the cause of clean air if the campaign for low-sulphur fuels and for sulphur removal led to an underestimation of the potentiality of chimneys.

No sulphur dioxide removal process—even if 100 per cent efficient—can make it possible to dispense with a chimney. A chimney can in most cases do all that a removal process could do at a fraction of the cost to the community. An efficient removal (or prevention) process is required for smoke and dust. There may also be a case for avoiding unnecessary nitrogen oxide formation. But a removal process for SO_2 would only make sense where the adverse circumstances of terrain or nearby an airport, or the social desirability of making the best use of high sulphur fuel, make the highest practicable chimney inadequate. Even then it would only be needed for comparatively infrequent periods, need not be more than partial unless the process cools the gases, and should still not be considered until after potentially cheaper means of reducing pollution during these periods, have been rejected as impracticable.

The authors believe that the toxicity of sulphur dioxide has been exaggerated. Sulphur is present in coal partly because it is essential to plant life. If the ground level concentrations of sulphur dioxide are sufficiently low the gas not only becomes harmless, it may be beneficial.

The authors also believe that much of the aesthetic objection to tall stacks is rooted in the observation that far too many chimneys have in the past, and still do, emit unnecessary quantities of smoke and visible particulate matter. In order to create pressure for improved air pollution control, some spokesmen for clean air have been over-critical of tall stacks dispersion of the invisible constituents, and have encouraged the public to believe that this control measure is neither adequate nor acceptable. This contrary to the public interest. It has caused, and continues to cause, the expenditure of engineering manhours and huge research funds on a problem for which an answer exists, thereby diverting them from the real problems of air pollution; these are the emission of smoke and particulates, the low-level emission of sulphur dioxide in cities and, in some areas, the emission of unburnt hydrocarbons from vehicles.

Pollution is not merely an industrial problem. It is a neighbourhood problem. Citizens who point critically to the power station burning 3 per cent sulphur oil with an adequate chimney and ignore the 0·3 per cent of sulphur in the heating oil used by themselves and their neighbours do not understand the facts. If citizens believe that SO_2 is harmful to them and consider that its concentration in the air they breathe should be reduced, then the remedy is the most stringent restriction on the sulphur content of the fuel they themselves use in their daily lives and the provision of adequate chimneys for large industrial sources.

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National Society for Clean Air

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The parents of the Society were the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant, and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

National Society For Clean Air

NEWS FROM THE DIVISIONS

YORKSHIRE

The 24th Annual General Meeting of the Yorkshire Division was held in the Council Chamber of the Civic Hall, Leeds, on Wednesday the 31 March, 1971, and was preceded by a short meeting of the Yorkshire Divisional Council. The Annual General Meeting was attended by 80 members and representatives from the Division.

The formal business of the meeting was followed by three brief addresses.

The Director of the Society first spoke on "The Future Aims of the National Society for Clean Air".

Admiral Sharp said that the basic aim of the Society—Clean Air—was unchanged, but the emphasis had changed. The aim in the early days was essentially smoke abatement but since the introduction of the Clean Air Acts smoke in the atmosphere had diminished considerably and other pollutants were becoming more noticeable such as grit and dust, sulphur dioxide and specific emissions from industrial plants such as brick works, cement works, oil refineries, the iron and steel industry etc. Admiral Sharp said that he hoped the new grit and dust regulations would have a beneficial effect although he thought that the time lag of 7 years for existing furnaces being replaced was rather long. He said that enough was not known about the real effects on human health by sulphur dioxide and was the policy of natural dispersion by high stacks good enough? He said that there was an increasing need for the Society to work more closely with industry to the reduction of such pollutants.

Admiral Sharp said that it was essential that the effect of the recent shortage of solid smokeless fuel on the smoke control position be rectified. Suspended smoke control areas must be re-instated and it was also essential to press on with new smoke control areas in those places where it had not yet been established.

Turning to pollution from motor vehicles Admiral Sharp said that in spite of the promises, talk and publicity on this problem we still had no real legislation in this country and he felt that was it not time to take action on amenity grounds? He said that odours were becoming more apparent and much more research was needed on odours and their control.

Admiral Sharp said that the subject of pollution from aircraft was new but more and more people were becoming concerned and this subject would be discussed at the forthcoming Conference at Folkestone.

Partly as a result of Conservation Year Admiral Sharp said that there was a growing interest in the possible long term effects of atmospheric pollution on global weather and climate. He said that this was a subject for particular discussion at the Conference. There was a need for a balanced, common-sense view on these problems and the Society had a good reputation in this respect.

Admiral Sharp said that we could not clean the air at the cost of polluting other things and it was time to look at clean air and the environment as a whole. He said that should we not begin to concern ourselves with Noise which was a form of air pollution? He said that there was a necessity for keeping things in proportion and the economic factor, cost and who pays should be looked at.

Admiral Sharp said that there was a need to educate the public—especially the young—the young at universities and colleges of technology—they must be catered for and given a chance to be heard and to take part. In this, he said, the best recruiting sergeant was the member and if every member obtained one new member this would be a tremendous advance.

Admiral Sharp's address was followed by two short talks on the subject of "Solid Smokeless Fuel Supplies in Yorkshire—the immediate position and the future prospects". Mr. J. Menheneott, Regional Marketing Director, Yorkshire Sales Region of the National Coal Board, spoke on the producers viewpoint and Mr. P. J. D. Cooper, President of the Yorkshire Federation of Coal Merchants dealt with the distributors' viewpoint.

Mr. Menheneott said that before dealing with future prospects for solid smokeless fuel supplies in Yorkshire he wished to refer to the fuel position at this time last year. At that time many fears were being expressed about the availability of solid smokeless fuel for the coming winter because gas coke production was running down more rapidly than had been expected, and some of the new production of other solid smokeless fuels which was coming in looked as though it would be later than was originally anticipated. He said that beginning at about this time last year action was taken on a number of counts to see what could be done to improve the winter supply position. For example, a campaign was mounted to persuade local authorities and other bodies to convert coke burning appliances in schools and similar places to other fuels and thereby make more coke available for the domestic market. This development was not new—it had been going on for the past 15 or 20 years—but last summer the pace was speeded up. Additionally some delays were introduced in gas works closures, which although in the north West, must have reduced the pressure on solid fuel supplies in general. The Coal Board also sent Anthracite from South Wales to France, where there was spare capacity for briquetting, and the distributive trade themselves took action by importing certain types of smokeless solid fuels. In total the action taken, together with the reasonably mild winter, averted what

might have been a very serious position and had enabled us to get through the winter reasonably well, even though, it must be admitted there was a temporary slowing down in the Smoke Control programme.

Mr. Menheneott then referred to future prospects. He said that stocks of smokeless fuel generally throughout the country were much larger than they were at this time last year and that in the meantime there had been a number of developments which should hold us in good stead for the future. On the debit side, however, must be put the continuing running down in gas coke production. In Yorkshire only four of the old type of gas works producing coke had been in operation during this last year. Three of them, viz. Bradford, Tingley and Hull, had now closed or were closing shortly, and the last of the four at Huddersfield would close in May or June. There would, however, be some little stock of coke left from those works. On the credit side there had been developments by private producers. First the Grimethorpe extension of the Coalite plant was virtually complete and was on 100 per cent output. That had brought something like 250,000 tons extra a year of Coalite on to the market. That plant was being followed by the Rossington Plant which was now in course of construction and which would produce another 400,000 tons when in full production. It should begin to produce towards the end of 1971. So far as Rexco was concerned the plants were not in the Yorkshire area, but nevertheless any additional production from them must have a bearing on the total availability in the country. Rexco then were building a new plant on the East Midlands coal field which would produce about 250,000 tons. So far as the National Coal Board was concerned their Sunbrite works were being kept going at full production and because of reduced demands in other fields there would be more Sunbrite available for the domestic market. The Roomheat plant at Markham was now producing satisfactorily and the second stream at this plant would come into operation shortly. Two other plants outside Yorkshire send in some part of their production although they were not main suppliers, for example, the Phurnacite plant in South Wales had increased its capacity by some 200,000 tons and there would be consequently a bigger availability of this fuel in Yorkshire. The production of Anthracite in the South Wales coal field had increased. The Multiheat plant in South Wales was coming into full operation and there were a number of other plants which did not directly supply Yorkshire but which also added to the general supplies of solid smokeless fuels in the country.

He said that the overall increase in production was such that he was confident that, with the quite major output coming from the investments which had been made by both the independent producers and the Coal Board, all demands for solid smokeless fuel in Yorkshire could be met in the future in spite of the production of gas coke which had been lost.

Mr. Menheneott went on to speak about the positive work which was being done by the Coal Board in conjunction with appliance manufacturers in developing modern domestic appliances to burn bituminous coal smokelessly. He referred to the first appliance of this type, that is, the Housewarmer, many of which had been installed in the Yorkshire area. This appliance was specifically designed to burn bituminous coal without emitting smoke. It had a limited out-put but it did point the way for the future. However, the first of the new range of appliances using the same principle had now completed field trials and was coming into production. This was the Rayburn CB 34 which had been approved by the Appliances Approval Council and an application for exemption of this appliance under the Clean Air Act was before the Ministry. He said that other appliances using the same principle were to be introduced later this year and he thought that they had now reached the beginning of a really important development in clean air. One point of considerable importance was that there would be no difficulty about supplies of bituminous coal for these appliances. They would ensure good standards of heating and would operate at costs less than the costs of solid smokeless fuels and certainly less than that of gas or electricity.

Mr. Menheneott concluded by saying that from the producers angle we could go forward with confidence knowing that the production of solid fuel on the one hand, and the development of new appliances to burn coal smokelessly on the other, would together ensure that there would be no difficulty in meeting the requirements of solid fuels for future smoke control areas.

Following this Mr. Cooper for the distributive side said that what irony it was that in the anti-pollution year 1970 there had been so many suspensions and cancellations of smoke control areas. He said that as far back as 1968, pressure had been put upon the National Coal Board and the Government by the Chamber of Coal Traders, pointing out that there might not be sufficient supply to meet the anticipated demand. Mr. Cooper went on to say that by the Spring 1969, it had become increasingly obvious that the major problem in solid smokeless fuel supplies was the rundown in gas coke production. He said that the effect was masked for some time by the existence of stocks and other factors but in July 1969 the Chamber of Coal Traders made special representations to the Ministry and it was suggested that the closure of carbonisation works should be retarded. No urgent steps were taken until December 1969, when emergency meetings were held by the Ministry, attended by the Gas Council, National Coal Board, the independent smokeless fuel producers, the coke distributors and the Chamber of Coal Traders. The Gas Council said that it was possible to save some 200,000 tons at a cost of £9-£14 per ton to be met by "someone". This was put to the Government but notices were given to close the Gas Works, resulting in a loss of 8,000,000 tons of domestic type coke.

Mr. Cooper said that this led to the suspension of smoke control areas. Some twelve Local Authorities in Yorkshire had to suspend their Orders.

Mr. Cooper said that because of the suspension of orders and the mild winter merchants still had a good proportion of their solid smokeless fuel in stock and that for the next twelve months—April 1971-April 1972—the situation was likely to remain the same as for the year ended March 1971.

The talks were followed by an animated discussion and many questions were put about the figures quoted by the speakers and in particular about the rising costs of coal and solid smokeless fuels.

Light refreshments were served at the close of the meeting by the kindness of the Health Committee of the Leeds City Council.

J. H. Wyatt,
Hon. Secretary.

EAST MIDLANDS

The East Midlands Division visited the Coal Utilization Council Heating Centre at St. Peters Gate, Nottingham, on Thursday, 8 October, 1970, at the kind invitation of the Council, sixty-two members attending. Unfortunately this copy was held up in the postal strike and so could not be published previously.

The Meeting was opened by the Chairman, A. Wade, Esq., M.B.E., who introduced Mr. E. Wright the Regional Manager of the C.U.C. who in turn welcomed members to the Centre on behalf of his Council.

Explaining the Organization Mr. Wright said the concept of the Coal Utilization Council was wider than its title suggested, for while its constitution obviously demanded loyalty to coal and the solid smokeless fuels derived from coal, it was equally concerned with the efficient use of these fuels, and the types of appliances on which they were burned. The latter considerations were all important in the prevention of atmospheric pollution from domestic sources, and in consequence the aims of this Organization were in line with those of the National Society for Clean Air.

Mr. Wright said that services operated from the Centre fell under three main headings:

1 Services to the Building and Plumbing Trades in both an advisory capacity and by conducting practical instruction courses for operatives to qualify as Authorised Heating Appliance Fixers.
2 Conducting Courses for Technical Officers of Local Authorities i.e. Public Health Inspectors and Housing Managers, in the theory and practice of appliance installation.
3 Advice to the General Public in connection with Smoke Control Areas and assisting with problems encountered in such areas.

Mr. R. A. Johnson, C.U.C. Technical Training Officer was then introduced by Mr. Wright who enlarged on the Training Courses undertaken at the Centre and later dealt with questions raised by members.

A Film entitled "Devil of a Story" which demonstrated the manufacture and installation of a Domestic Solid Fuel Appliance was then shown and this was followed by a conducted tour of the Training Centre and the Showrooms where domestic heating appliances of all types were on display. Members were particularly interested in the "mock-up" installations of various types of appliances, with cut-away sections showing correct fixing and flue constructions, used in the training courses.

At the close of the morning session the party were entertained to an excellent buffet luncheon by kind invitation of the Coal Utilization Council.

The afternoon session opened with a most interesting address given by Mr. Attenborough the Senior Technical Instructor of the C.U.C. from the London Office, whose subject was "The Development of the Domestic Solid Fuel Appliance". This was in the nature of an historical survey which traced the development of the Room Heater over the last fifty years from "The Queen" cast iron appliance which stood on three legs, through the Round Free-standing Slow Combustion era to the modern recessed multi-coloured, glass-fronted appliance capable of supplying convected heat, domestic hot water, and full central heating, when using any of the whole range of solid smokeless fuels. Mr. Attenborough also dealt with the relative efficiencies of the appliances and with the economics of their use in Local Authority and private housing, particularly in Smoke Control Areas.

A fitting finale to a most interesting and instructive programme was Question Time when a panel of four composed of Mr. E. Wright, Mr. Brown, his Deputy, Mr. R. A. Johnson and Mr. H. B. Dunstan, Head of Domestic Sales Branch, N.C.B. Midlands Region undertook to answer members questions on the subjects raised during the day and on the wider issues of fuel supplies and distribution. Many questions were raised and a lively discussion followed which were ably dealt with by the Panel.

At the close of the session tea was provided at which the Chairman expressed the thanks of all the members of the Division to the Coal Utilization Council for making the meeting possible and for the generous hospitality provided, to Mr. E. Wright the Regional Manager and his staff for the comprehensive programme which had been arranged, and to speakers and members of the Panel for their interesting contributions to a most successful and worthwhile meeting.

G. Drabble,
Hon. Secretary

OBITUARY

Dr. W. R. Martine

We deeply regret to announce the death of Dr. W. R. Martine, O.B.E., T.D., who was killed in a motor accident on Monday the 3rd May 1971.

Dr. Martine was for many years a member of the Executive Council and was chairman of the Society. He was a staunch supporter of clean air and will be sadly missed. From all members of the Society we extend our heartfelt sympathy to Mrs. Martine in her great loss.

A full obituary notice will appear in the next issue of "Clean Air".

"Air Knows No Frontiers"

INTERNATIONAL NEWS

U.S.A.

Empire State System

In New York a computer system has been installed to fight against air and water pollution. The computer system, named the Empire State system, is one of the most advanced in the world and provides automatic electronic monitoring of air and water conditions throughout much of New York State. The computer, a Burroughs B3500, is installed at the headquarters of the Department of Health and provides a constant flow of data from 12 water monitoring and 11 air monitoring stations.

The Officials of the Department of Environmental Conservation and Health, as a result, are provided with almost instantaneous warnings and information on excessive levels of pollution.

In the longer term, the continuity of the computer surveillance is particularly important as New York's pollution abatement programme contains a range of activities from intensified enforcement and research to the construction of special industrial and municipal waste treatment devices. The comprehensive data collected by the system provides the realistic basis for evaluating progress on this programme.

Operation of the Empire State system begins at the field monitoring stations where environmental sensors measure either 10 water characteristics including dissolved oxygen concentration, temperature and turbidity, or 18 air characteristics from sulphur dioxide content to relative humidity. The field stations are fully equipped with automatic pumping, sampling and testing devices. Because of the need for special chemical analysis and testing on certain air quality values, the air monitoring stations are manned for 8 hours a day.

The computer maintains a schedule of monitoring station telephone numbers and automatically calls each station over ordinary telephone lines at intervals of between 15 minutes and one hour. When contact is made, the computer instructs the station to transmit all the latest data on air or water. As soon as the message is received, the computer edits the information and if certain pre-set criteria are not met, an alarm automatically goes to a specialised division of the Department. Every day a complete round-up of the day's activities is compiled automatically by the computer and is available for Department executives first thing every morning.

If levels of air pollution become dangerously high, the air monitoring programme reacts so that municipalities affected can be warned and other appropriate measures taken, according to the priority of the alert and degree of danger indicated, such measures can range from an initial level of ordering municipal incinerators to curtail their burning, to restrictions on other pollution sources, including power generating stations and non-essential traffic.

Hourly and daily, average reports on air pollution are prepared and transmitted to many newspapers for publication in air pollution index reports.

Unlike many other pollution control programmes, the Empire State system is not an overnight reaction to a growing public concern about pollution. Its history goes back 10 years when the Department of Health first considered the idea of establishing an automatic monitoring system. Initial steps included extensive studies of similar systems elsewhere, and a pilot project of two remote stations. The first automatic electro-chemical sensor type of water monitor was bought in 1966 and installation of the computer was completed in 1968. A year later, after extensive and rigorous testing, the system went into operation.

Clean Air Amendments of 1970

The last month of 1970 saw the enactment of important changes in the Federal Clean Air Act, plus the formal establishment of the Environmental Protection Agency with Mr. William D. Ruckelshaus as its first administrator. Below is a brief summary of the main provisions of the new act.

Research: "The Environmental Protection Agency is directed to give special emphasis to studies of the health and welfare effects of air pollution. Funds are available."

Grants for air pollution control programmes: "Higher-ratio grant support of State operated regional programmes is authorized."

Air quality control regions: "The Environmental Protection Agency is authorized to continue designating interstate and major intrastate regions for 90 days after enactment."

National air quality standards: "Environmental Protection Agency is to promulgate national primary and secondary air quality standards."

State implementation plans: "States would be expected to adopt plans for implementation of national air quality standards in all areas."

New source performance standards: "Environmental Protection Agency is to establish performance standards for new stationary sources. Performance standards to reflect emission limitations attainable through use of best emission reduction systems."

Hazardous emission standards: "Environmental Protection Agency is to establish standards for stationary source emissions of pollutants which are not covered by national air quality standards and which may cause or contribute to an increase in mortality or and increase in serious irreversible or incapacitating reversible illness."

Federal enforcement: "After 30 days notice to polluters and States, Environmental Protection Agency can issue orders or bring civil action to stop violations of State implementation plans."

Inspections, monitoring and entry: "For purposes of developing or assisting in the development of State implementation plans, new source performance standards, or hazardous emission standards, identifying violations of standards or plans, or taking emergency action, Environmental Protection Agency is empowered to require polluters to keep records and make reports and to install and use monitoring equipment. Environmental Protection Agency also given right to entry for above purposes."

Abatement conferences: "may not be called with respect to any pollutants for which national air quality standards have been promulgated."
Federal facilities: "are to comply with the Act and requirements established under it in the same manner that non-Federal organizations are required to comply."
Motor vehicle emission standards: "New light-duty motor vehicles must achieve 90% reduction from 1970 vehicle emissions of carbon monoxide and hydrocarbon by the 1975 model year and 90% reduction from 1971 vehicle emissions of nitrogen oxides by the 1976 model year."
Compliance testing and certification: "Environmental Protection Agency is authorized to test prototypes of new motor vehicles and issue certificates of conformity valid for a maximum of one year."
Compliance by motor vehicles in use: "Effective with model years beginning more than 60 days after enactment, manufacturers must warrant that vehicles are designed, built and equipped to conform with applicable emission standards and are free of defects that would lead to non-conformity during the vehicles' useful life (which must be five years or 50,000 miles)."
Regulation of fuels and additives: "Provisions for registration of fuels and additives are modified to permit Environmental Protection Agency to request more data and to require manufacturers to conduct tests." "Environmental Protection Agency authorized to control or prohibit sale of fuel additives on basis of danger to public health or welfare."
State regulation of vehicles and fuels: "No change in existing Act."
Grants for State Inspection: "Environmental Protection Agency can make grants to States for up to two-thirds."
Procurement of low-emission vehicles: "Federal Government can pay up to 50 per cent of applicable statutory price limitation for vehicle certified by Board and up to 200 per cent if vehicles incorporate inherently low-pollution propulsion system."
Aircraft emission standards: "Within 90 days after enactment, Environmental Protection Agency must initiate study of impact of aircraft emissions."
Emergency powers: "Environmental Protection Agency authorized to go to court to enjoin pollution in cases where substantial endangerment to health is imminent."
Noise: "Environmental Protection Agency directed to set up Office of Noise."

Bay Area Air Pollution Control District
The Board of Directors of the Bay Area Air Pollution Control District appointed seven new members to the District's Advisory Council at its January meeting.

One unspecified position was filled by the appointment of Mr. Byron Chaney, Fire Chief of Mountain View, Santa Clara County. Other new appointments were Mr. Kenneth Hayes, M.D., an Internist and Chairman of the Santa Clara County Medical Society's Environmental Pollution Committee; Mr. Walter Toney, Director of the Recreational and Parks Department of the City of Berkeley; Mr. D. G. Hammond, Assistant General Manager of the Bay Area Rapid Transit District; Ruth Church Gupta, Attorney at Law, representing the TB and Health Association of San Francisco; Doctor Walter O. Clowers, Public Health Officer of Sonoma County; and Doctor Howard E. Cogswell, member of the Board of Directors of East Bay Regional Park District.

Money Spent on Pollution Control
The Du Pont Company plans to spend more than 300 million dollars on air and water pollution control in the United States over the next three years despite the hundreds of millions spent on it over the past quarter century, about half this expenditure will be for the construction of equipment to abate pollution at company plants and laboratories, and half to operate and maintain both existing and new pollution control equipment.

In Europe, the recently built plants of Du Pont subsidiaries are all equipped with process equipment specifically designed to avoid pollution. Investment in additional waste treatment and other control facilities was more than five million dollars. The cost of operating this equipment was about two million dollars.

FRANCE

The French Prime Minister has issued in the official Bulletin, a decree establishing the Environmental Committee. This Committee will be dealing with the problems of improvement of living space, crowding, pollution and nuisances of all kinds, management of the landscape and in general all the positive and negative elements involved with man and his environment. The Committee will offer guide-lines on environmental policies within the administration of the Land and of Economic and Social Development. Nine representatives of the government and nine others chosen for their competence, will form this Committee, for a period of three years, to be renewed by the Prime Minister.

WEST GERMANY

The government of West Germany has launched a multi-billion dollar campaign to purify its polluted air and waters. The campaign is the outgrowth of a study which showed that West Germany's air is seven times as polluted as that of the United States and equalled only by Japan; recycled waste waters used by 36 million of the 60 million citizens are insufficiently purified; two-thirds of all refuse is disposed of so carelessly that underground water resources are endangered; and every second person suffers ill effects from some kind of noise. Environmental control has been vested in state governments in Germany, but the federal government is pressing for a bill which would give it law enactment and enforcement privileges for air, water, conservation, and noise control.

AUSTRALIA

Clean Air Conference 1972—Melbourne
An international conference sponsored by the Clean Air Society of Australia and New Zealand and the University of Melbourne, will be held at the University for three days from 15 to 17 May, 1972.

Abstracts of papers are now invited from authors, covering the science, technology and engineering of air pollution and its control. The areas of the different symposia will be:

- Meteorology and atmospheric effects
- Medical and biological research
- Sociological factors
- Sources and control of air pollutants
- Measurements and surveys.

Prospective authors and participants should submit *abstracts* of proposed papers by 15 June, 1971, to: The Organizing Secretary (Dr. W. Strauss), 1972 Clean Air Conference, National Science Centre, 191 Royal Parade, Parkville, Victoria 3052, Australia.

The Organizing Secretary would also be interested to hear from those who wish to attend the Conference, but do not intend to present papers, so that their names can be placed on the mailing list for registration forms and programmes.

SMOKE CONTROL AREAS

Progress Report

Position at 31 March 1971

(Figures supplied by the Department of the Environment)

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smokeless Zones (Local Acts) in Operation	44			—			—			—		
Acres, 3,400												
Premises , 41,060												
Smoke Control Orders Confirmed prior to 1/1/71	3,377			8			142			*Smoke control Orders in operation* 31		
Acres		948,559			1,097			74,948			8,284	
Premises			4,702,082			4,979			353,983			15,443
Smoke Control Orders Confirmed	31						4			2		
Acres		11,134										
Premises			63,851									
Submitted	67						2			4		
Acres		28,428										
Premises			111,252									
Grand Totals	**3,519**	**988,121**	**4,877,185**	**8**			**148**			**37**		

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 31 March 1971

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	40,170	32·1	162,472	29·4
Yorkshire & Humberside	191,397	50·8	640,614	54·9
East Midlands	67,806	25·3	204,111	39·9
Greater London	246,202	75·3	2,169,146	82·2
North Western	198,501	49·5	828,533	48·7
West Midlands	85,893	34·5	394,821	37·5
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	837,474	47·2	4,428,394	57·0
Outside black areas ..	8,958		17,729	
Grand Totals	**846,432**		**4,446,123**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue **Clean Air (Spring 1971)** *which gave the position up to* **31 December, 1970.** *They now show changes and additions up to* **31 March, 1971.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of the Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

North Western

South Lancashire and North-East Cheshire
Oldham C.B. (No. 19).

Local Authorities Outside the Black Areas

Winsford U.D. (No. 11).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Teesside
Teesside C.B. (No. 6).

Yorkshire

West Riding (North)
Horsforth U.D. (No. 30). Leeds C.B. (Nos. 87, 88 and 89).

North Western

South Lancashire and North-East Cheshire
Stockport C.B. (Heaviley/Hillgate 1970). Oldham C.B. (No. 17, 18 and 19).

Central Lancashire
Rawtenstall B. (No. 2). Accrington B. (No. 10). Burnley C.B. (No. 12). Darwen B. (No. 8).

Merseyside
Birkenhead C.B. (No. 7). Warrington C.B. (Nos. 14 and 16). Bebington B. (No. 16).

Midlands

Derby, Nottingham and Chesterfield
Chesterfield R.D. (No. 11). Derby C.B. (No. 20). Dronfield U.D. (No. 6). Blackwell R.D. (No. 1).

London

Greater London Boroughs
Bexley L.B. (No. 11). Kingston-upon-Thames L.B. (Nos. 18 and 19). Richmond-upon-Thames L.B. (Twickenham No. 10). Ealing L.B. (Nos. 49 and 50). Merton L.B. (No. 18).

Local Authorities Outside the Black Areas

Crawley U.D. (Three Bridges). Tamworth B. (No. 5). Winsford U.D. (No. 11).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Tyneside and Wearside
Gosforth U.D. (No. 1). Jarrow B. (No. 5).

Yorkshire

West Riding (North)
Leeds C.B. (Nos. 90, 91, 92 and 93). Elland U.D. (South Ward). Morley B. (No. 42). Horsforth U.D. (No. 31).

West Riding (South)
Hoyland Nether Hay U.D. (No. 1). Sheffield C.B. (No. 27).

North Western

South Lancashire and North-East Cheshire
Farnworth B. (No. 5). Salford C.B. (No. 21). Radcliffe B. (No. 6). Stalybridge B. (Castle Hall No. 3). Audenshaw U.D. (No. 6). Droylesden U.D. (No. 14). Ashton-under-Lyne B. (No. 13). Eccles B. (No. 13). Royton U.D. (No. 7). Worsley U.D. (No. 9). Horwich U.D. (No. 3). Leigh B. (No. 12). Prestwich B. (No. 11).

Central Lancashire
Preston C.B. (No. 23). Rawtenstall B. (No. 3).

Midlands

Derby, Nottingham and Chesterfield
Sutton in Ashfield U.D. (No. 1, 1970). Kirkby in Ashfield U.D. (No. 5). Beeston and Stapleford U.D. (No. 12). Carlton U.D. (No. 8). Ilkeston B. (No. 5). Derby C.B. (No. 21).

North Midlands

Leicester C.B. (Nos. 28 and 29).

West Midlands

Sutton Coldfield B. (No. 19). Birmingham C.B. (No. 157). Solihull C.B. (No. 17). Coventry C.B. (No. 15).

London

Greater London Boroughs
Kensington and Chelsea L.B. (North and South Stanley). Greenwich L.B. (Nathan Way; Royal Arsenal Enclave; Riverside; Plumstead No. 2; Page Estate; Abbey Wood No. 4). Ealing L.B. (Nos. 52, 53 and 54). Sutton L.B. (No. 24). Croydon L.B. (No. 13). Lambeth L.B. (No. 25).

Local Authorities Outside the Black Areas

Saddleworth U.D. (No. 2). Peterborough C.B. (No. 2). High Wycombe B. (No. 17). Southampton C.B. (No. 11). Market Drayton R.D. (No. 1). Potters Bar U.D. (No. 4). Reading C.B. (Nos. 15 and 16). Staines U.D. (No. 12). Wortley R.D. (Grenoside). Runcorn R.D. (No. 5). Meriden R.D. (No. 5). Easington R.D. (Peterlee No. 1). Skipton U.D. (No. 7). Ramsbottom U.D. (No. 4).

SCOTLAND

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Bearsden (Westerton No. 3). Falkirk (No. 9). Galashiels (Town Centre). Hamilton (No. 3 Fairhill/Laighstonehall—Remainder).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Bishopsbriggs (No. 3 (Auchinairn/Springfield)). Hawick (Lynnwood).

NORTHERN IRELAND

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Lurgan B.C. (No. 3). Newtownabbey U.D.C. (No. 4).

ORDERS SUSPENDED

Since the last issue of *Clean Air* the following additional local authorities were granted orders by the Department of the Environment to suspend the operation of their existing Smoke Control Orders because of the shortage of solid smokeless fuels. All were effective until the 30 April, 1971.

Harlow U.D. (all operative orders).

Southport C.B. (No. 1 Dock Lane, 1970).

Stockport C.B. (No. 1 1958 and 1960; Cheadle Heath (Bridgehall); Edgley Park; Cheadle Heath (Brinksway); Ashton-under-Lyne B. (Nos. 1, 2 and 3).

AIR POLLUTION ABSTRACTS

1235 Urban and Social Origins of Childhood Bronchitis in England and Wales. Colley, J. R. T., and Reid, D. D. (Brit. Med. J., April 25, 1970). A survey of respiratory disease in over 10,000 children aged 6 to 10 years living in contrasting urban and rural areas of England and Wales showed pronounced social class gradient in the frequency of chronic cough, history of bronchitis, and also in disease of ears and nose. A consistent rise in the frequency of chest conditions with increasing local levels of air pollution was clearly seen only among children of semi-skilled and unskilled workers. No such gradient was obvious for diseases of the ear and nose. These trends in chest disease in children paralleled similar trends in mortal and disabling bronchitis among adults in the same areas. The excess rate for bronchitis in children and adults found in South Wales could not be accounted for by local levels of air pollution.

1236 Atmospheric Emissions from Chlor-Alkali Manufacture. Environmental Protection Agency, Air Pollution Control Office, Research Triangle Park, North Carolina, January 1971. This report—one of a series concerning atmospheric emissions from chemical manufacturing processes—provides information on the range of emissions that occur under normal operating conditions and the use of established methods and devices employed to limit or control emissions from the manufacture of chlorine and caustic. Although the report centres around the electrolytic production of chlorine and caustic from brine, it also touches upon the use of fused-salt cells for the manufacture of sodium and chlorine, minor chemical processes for the manufacture of chlorine, and the time-soda method for caustic manufacture. Only processes directly involved in the manufacture of chlorine and caustic have been examined.

Background information is included to define the importance of the chlor-alkali industry in the United States. Basic characteristics of the industry are discussed, including growth rate in recent years; manufacturing processes; uses for the products and the number and location of production sites. A description is given of the electrolytic process. Process information includes the discussion of normal process variables that affect the range and quantities of emissions and methods of controlling or reducing emissions. Supplementary material provides detailed emission-sampling and analytical methods.

1237 Air Quality Criteria for Nitrogen Oxides. Environmental Protection Agency, Air Pollution Control Office, Washington, D.C. January 1971. This publication reviews the chemical and physical characteristics of the nitrogen oxides and considers the relative merits of various analytical methods for measuring them in the atmosphere. It also discusses their effects on visibility, vegetation and materials; their toxicological effects on animals and on man; and epidemiological studies that assess the general population dose response and the specific response of children to nitrogen oxides. In general, the terminology employed follows usage recommended in the publications style guide of the American Chemical Society. A conversion table for mass and volume units of measurement, and a subject index are provided.

1238 Literature Survey on the Health Aspects of Lead Emissions from Gasoline Engines. Blokker, P. C. Stichting Concave, The Hague. Report No. 24/70. December 1970. The principal sources of lead in the atmosphere are the combustion of gasoline, containing lead anti-knock additives, and coal. The possible effect of lead contamination on man's environment are of concern to many health authorities. The quantities of lead to which people are exposed are known or can be estimated with sufficient accuracy, but there is no agreement on the biochemical effects at the low concentrations found in the atmosphere over urban areas and on sensitive groups in the population.

In this survey a summary is given of literature information on concentrations in the air and body organs and on the effect atmospheric lead may have on reactions of human populations. In a number of cases reference is not made to specific articles but to a number of extensive surveys.

The survey considers that the published information does not permit any positive conclusions concerning an identifiable hazard to human health at the prevailing levels of lead pollution in the atmosphere; but if there is any bias, it tends towards the opinion that there is no valid evidence of a hazardous effect. However, concern over possible chronic effects remains and the periodic assessment of all research concerning atmospheric pollution by lead, including both epidemiological and laboratory studies, is essential to ensure that any positive evidence of a health hazard is correctly identified and evaluated at the earliest opportunity.

1239 Continuous Measurement of Carbon Monoxide in Streets 1967-1969. Reed, L. E., and Trott, P. E. (Atmosph. Environ. 5(1) January 1971). This report describes continuous measurements of carbon monoxide made at one site in each of several cities in Great Britain for periods of 13-15 months during 1967-1969. The survey was carried out on behalf of the Ministry of Transport to obtain information on concentration levels of carbon monoxide found in the street and the frequency and duration of their occurrence. High concentrations were not found at any of the sites. The proportion of time each month when carbon monoxide concentration exceeded 30 ppm ranged from below 0·01 to 1·92 per cent.

1240 Economic Effects of Sulphur Dioxide on Forest Growth. Linzon, Samuel N. (J. of Air Poll. Control Assoc. 21(2) Feb. 1971). The body of information presented in this paper is directed to ecologists concerned with the effects and economic impact of sulphur dioxide on forest growth. Investigations were carried out over a ten-year period, 1953-1963, in the Sudbury smelter district of Ontario,

where three large smelters discharge annually approximately 2,000,000 tons of sulphur dioxide gas into the surrounding atmosphere. The study was designed to determine the long-term chronic effects of sulphur dioxide on yield, growth and survival of plant life. Since Eastern white pine is the most susceptible coniferous tree to sulphur dioxide injury, it was selected as the indicator tree to determine the degree and extent of injury in the Sudbury area. Tree data accumulated from the sample plots were correlated with records of atmospheric sulphur dioxide monitored continuously during the growing season by a network of ten strategically-located Thomas autometers. Based on the degree of injuries exhibited by the trees, and on air sampling records of sulphur dioxide, the Sudbury area was segregated into three fume zones: Inner, Intermediate, and Outer. An estimate was made of the loss in income suffered by the owners of wood or the producers of wood products in the Sudbury area as a result of sulphur dioxide air pollution, by utilizing the white pine volume growth loss data.

1241 The Present State of Pollution in Japan. Hashimoto, Michio. (Air Conditioning Refrig. 10(2) Jan. 15, 1970. Text in Japanese.) Pollutions in Japan are reviewed from the social viewpoint as well as in relation to the situations before and after the passing of the Basic Public Nuisance Control Law and the existing state of contamination and the new understanding of health. The change of energy source from coal to petroleum since 1955 produced new types of industrial pollution, and the high rate of economic growth also produced the urban pollutions. Contamination of Yokkaichi was the start of the present pollution problems, and it was followed by the investigations and the passing of several control laws. Enforcement regulations were completed and the emission limitations were strengthened. Local governments also established regulations. The establishment of the environmental standards was enabled by the Basic Law, and later the standard for sulphur oxides was passed. General noise and carbon monoxide pollutions are now being discussed as to their environmental standards, and standards for special types of noise, fine particles, hydrocarbons, oxidants, nitrogen oxides and exceptionally harmful substances are expected to be established. The Public Nuisance Control Plans are also under way together with the provisions for relief measures for pollution victims. Results of investigation of air pollution in 1968 are presented. Water pollution is also described in terms of methyl mercury and cadmium diseases.

1242 Measurement of Dust Concentration and Size in Ducts and Chimneys. Ball, D. F. and Griffiths, D. L. (Environ. Health J. of A.P.H.I. 79(2) Feb. 1971). One of the considerations governing the choice of gas cleaning equipment must be the size of the dust particles. A knowledge of the distribution of particle sizes is vital in the choice of suitable plant and also in monitoring the efficiency of plant already in service. A complete physical characterisation of a particle must include a description of its size, shape, density and structure. Size analysis methods depend on some phenomenon that is markedly influenced by particle size to discriminate between particles of different size. Four methods are discussed in detail in the following order: (a) Physical barrier—sieving. (b) Terminal settling velocity—sedimentation. (c) Imaging—microscopy. (d) Electrical resistance—pulse counting. (See also Environ. Health, 79(1) Jan. 1971).

1243 Environmental Health Problems of Urban Areas. Ward, E. W. (Environ. Health, 78(3) March, 1970). Environmental pollution, industrial effluents, pollution of the sea, solid wastes, air pollution from road vehicles, industrial air pollution, domestic smoke control, noise pollution, food inspection, housing in urban areas and environmental planning are reviewed for Great Britain. The natural resources of the world are consumed at an alarming rate, and the logical approach to solid waste disposal is one of conservation, to minimize generation of waste material, to salvage and reuse waste, and to dispose of the irreducible amount in a manner which will conserve the disposal site, or if incinerated, produce steam for district heating. Combustion of fossil fuels, represents a danger to health, causes damage to materials, and impairs agricultural efficiency. Effects of low chimneys, pollution by sulphur dioxide, and town planning are discussed. Noise protection zones and the effects of heavy vehicles on minor roads are mentioned. Food poisoning, contamination and food hygiene regulations are reviewed. Clearance programmes, housing rehabilitation, and multiple occupation are included, as well as an appendix with financial data for dwelling improvements. The unplanned sprawl of towns and cities, the gross pollution of the environment, the extinction of many forms of life, the ignorance of man, and the inadequacy of education places an impossible strain upon our resources.

1244 Photochemical Aspects of Air Pollution: A Review. Altshuller, A. P., and Bufalini, J. J. (Environ. Science and Tech. 5(1) January, 1971). The literature (some 133 references) on photochemical aspects of air pollution is reviewed. Topics include photochemical mechanisms, synergistic effects in the photo oxidation of organic substances, hydrocarbon reactivity scales, aerosols, natural air pollution, and actinometry. The review also notes areas for further research, including studies on olefins and arenes from combustion sources and the fate of organic and inorganic chemical species on a global scale. Effects of photochemical species on plants are not covered.

1245 Fumeless Refining and Powder Injection in Steelmaking. Steel Castings Research and Trade Association (Proc. of one-day conference, Sheffield, September, 1970). The process for the fumeless decarburization of steel by oxide injection which has been developed by the Steel Castings Research and Trade Association, Sheffield, consists of injecting a powdered metal oxide directly into the liquid steel bath in order to promote a vigorous carbon boil without the emission of brown fume which is normally associated with oxygen lancing. It has been successfully used on arc furnaces up to 120 tons in capacity, open hearth furnaces up to 250 tons and active hot metal mixers up to 600 tons. The Proceedings contain the following papers: Powder Injection—SCRATA Development Work; Production Scale Trials at David Brown Gear Industries Ltd.; Production Scale Trials at Workington Iron and Steel Company; Operating Experience with Powder Injection at F. H. Lloyd & Co. Ltd.; Operating Experience with Powder Injection at Steelcast Ltd.; Operating Experience with Powder Injection at Blackett, Hutton & Co. Ltd.; Operating Experience with Powder Injection at the North British Steel Group Ltd.; Powder Injection to Assist Steelmaking in Open-Hearth Plants. Full discussion on these papers is given, and a contribution on the future problems by Mr. C. M. Stock (Assistant Director, SCRATA), a statement by H. M. Chief Alkali Inspector on the acceptance of the process in the U.K. and closing remarks by Dr. H. T. Hall (Director, SCRATA).

BOOK REVIEWS

Economic Impact of Air Pollution Controls on Gray Iron Foundry Industry

National Air Pollution Control Administration, Publication No. AP-74. U.S. Government Printing Office. 65 cents.

The Clean Air Act in the U.S.A. requires the carrying out of economic studies into the effect of air quality standards on the nation's industries. For the grey iron-foundry industry, this was made by the National Air Pollution Control Administration helped by a number of other bodies, including the American Gray and Ductile Ironfoundries Association and the American Foundrymen's Society.

The industry had an output of about 15 million tons in 1966, the year for which most of the data was collected, and accounted for 2-3 per cent of the particulate matter emitted by all industrial processes. A sample of 240 foundries (17 per cent of the total) was chosen for financial analysis and deliberately included only corporate foundries making castings for sale.

Information from Tax Returns showed that the level of profit before tax was 6·9 per cent, compared with 8·1 per cent for all manufacturing industries. The spread of profit was very wide from −6·84 per cent to 15·79 per cent and in general, showed that the bigger the foundry, the greater was the profit compared with gross receipts. Perhaps the most surprising result was that foundries using cupolas or arc furnaces without pollution controls made slightly less profit than those having controls, but the size of sample in some output categories was small and the results may be suspect. It was concluded that the ironfoundry industry:

"Was in an economic position to assume air pollution control expenditures."

Pollution control costs depend on the standards which have to be reached. Each State may set its own standard, but the report states that the most logical form of standard is one based on process weight. As the process weight increases, a smaller proportion of the throughput may be emitted. This has the result of requiring more expensive and efficient control equipment for large plants than for small plants which, in general, make less profit with which to purchase and run such equipment. Coupled with weight emission, opacity limits are common. So far as cupolas are concerned, to come within the required opacity limits set in some states, only fabric filters, high intensity wet scrubbers or electro-static precipitators can be used. Alternatively, electric induction furnaces could be installed which require no control equipment. Since 1969, the Tax Reform Act has provided a five year straight-line depreciation for air pollution control equipment excluding chimneys.

A survey of the control equipment in the 1 376 known U.S.A. foundries showed that in 1967, 11 per cent had some form of control equipment. In general, these were the bigger foundries and accounted for 40 per cent of the value of castings made. The total included simple 'wet caps' (simple wet arresters). It is on the Pacific coast that control regulations have so far had the most effect on iron foundries. In California, 54 of the 64 foundries were controlled or used furnaces not requiring control.

The survey showed that the most popular form of high efficiency collector was the fabric filter, followed by wet scrubbers and multi-cyclones. Only one foundry in the U.S.A. used an electro-static precipitator to control cupola emissions.

An economic study of six hypothetical plants covering the range of a 4 ton per hour cupola used for three hours on 175 days per year up to a 20 ton per hour cupola used 16 hours per day for 250 days per year, was made to find the effect of the cost of fitting fabric filters or high intensity scrubbers on the profitability of the foundries concerned. As might be expected, the impact of pollution control costs was much higher on the smallest foundry than on the largest. For the small foundry, the fabric filter for the cupola cost 19 per cent of total investment, while depreciation, maintenance and the running costs accounted for 59 per cent of the annual before profit taxes, or 2·3 per cent of the annual value of castings sold. These figures reduced to 5 per cent, 11 per cent and 0·7 per cent for the largest foundry considered.

The report is furnished with extensive appendices to back up the mainly summary information given in the body of the report. The report is sometimes confusing, e.g. two different figures are quoted for the emission of solid matter by the industry. On page 1, it is stated to be 2·3 per cent (150 000 tons) of the national annual industrial emission, while on page 49, it is given as 2·9 per cent (190 000 tons). It is, however, worth while studying by all those interested in ironfoundry air pollution but should not be taken as representing the conditions existing in Western European countries.

F. M. Shaw

Reader Enquiry Service No. **7156**

The Population Bomb

Dr. Paul R. Ehrlich. Ballantine Books in Association with Pan Books. 30p.

"The battle to feed all of humanity is already lost. The famines of the 1970's are upon us," claims Dr. Paul R. Ehrlich.

The intention behind Dr Ehrlich's book seems to be to frighten people out of their apathy and ignorance of the implications of overpopulation. Overpopulation, he claims, is the biggest single threat to the survival of mankind. "We already know that it is impossible to increase food production enough to cope with continued population growth." "Two billion people are not being fed properly in 1971." "Five million Indian children die each year of malnutrition."

He suggests, rather vividly, that population is the dominent problem in all our personal, national and international planning. The book discusses the crisis in all its aspects and suggests the options open to mankind.

The author claims that time is running out. The doubling time of the earth's population seems to be about 35 years. The world population reached two billion around 1930: at present it is 3·5 billion, and so by the year 2000 it could be as many as 7 billion, The biosphere simply cannot sustain that many people. The 1970's therefore, must be the decade of decision. We have only nine years in which to find a solution and we shall have to choose between a lower birth rate or a higher death rate.

The author makes the point that the developed countries can no longer regard the problem of the population-food gap as something that does not affect them, for the developed countries are largely responsible for the depletion of the world's finite resources.

"The United States, with less than 1/15th of the world's population, uses well over half the world's raw materials consumed each year" and the U.S. also produces almost 50 per cent of the world's pollution, states Ehrlich.

According to "Population", a document prepared by the Research Department of the Labour Party, Britain is already one of the most densely populated countries in the world and is already overcrowded. Britain, as a whole, has a population density of 606 persons per square mile while England has a population density of 910 persons per square mile—four times the density of China and sixteen times the density of the U.S.A. By 2001 farm yields in the U.K. must increase by 80 per cent if we are to continue to grow half the food required for our population.

Reader Enquiry Service No. **7157**

Chemical Control of the Human Evironment
Butterworths, London, 1970. pp 141 + v. £3·50.

This book brings together eight plenary lectures given in July, 1969 in Johannesburg at an international symposium on the subject, that was organized by the International Union of Pure and Applied Chemistry in conjunction with the Council for Scientific and Industrial Research and the Chemical Institute of South Africa. The lectures are also published in "Pure and Applied Chemistry" Vol. 21, No. 3 (1970).

The first five of the lectures, on pest control, toxic substances in food, alfatoxin, pesticide residues in the total environment, and the public health hazards with the non-medical and animal health usage of antimicrobial drugs were given by experts from universities and other specialised research laboratories in the U.S.A.; the sixth lecture on man's control of water quality was by K. J. Ives of University College, London, the seventh on air pollution within the chemical industry of West Germany by W. Teske and the eighth on survey of the hazards of the chemical age by R. Truhaut of the Toxicological Research Centre of the University of Paris.

Reader Enquiry Service No. **7158**

Of the several lectures, the one of most interest to those concerned with problems of mitigation of air pollution is that on the problems within the chemical industry of West Germany. In one lecture it is not possible to give technical details in relation to all the many branches of chemical industry. The lecturer, however, has given an excellent resumé, with examples of selected problems. There are sections on legislation in West Germany, and on measures to decrease the emissions from manufacturing processes by modification of the processes and by treatment of the exhaust gases. The examples include emissions from the production of sulphuric and nitric acids, dust from the manufacture of calcium carbide, production and use of chlorine, compounds of fluorine from the manufacture of superphosphate, and exhaust gases from viscose factories.

The well-arranged and interesting lecture by R. Truhaut is also useful to all concerned with air pollution. It gives an account of types of toxicity and examples of toxic hazards, including the therapeutic use of chemicals, occupational exposure, chemical agents in foodstuffs, exposure of the general public to air pollution, and the use of chemicals in households; and there is a section on the general principles for preventing or reducing the hazards.

Every lecture is of interest to those concerned with the various facets of the human environment.

A. Parker

Reader Enquiry Service No. **7159**

Energy Resources for Western Europe
Association for Coal in Europe. 37 pages. 75p.

For more than a decade, Western Europe has benefited from a world energy surplus. The discoveries of massive oil reserves in the Middle East and North Africa and large natural gas deposits in Europe itself, the abundance of American coal in world markets, the low cost of shipping, and the promise of nuclear power, all combined to bring about a general reduction in fuel prices, particularly in oil.

However despite the considerable efforts made by the oil industry, and despite the promises of the nuclear energy industry, the world energy market has since 1969 been showing more and more signs of tension. This has affected nearly all forms of energy competing with European coal:

- mounting difficulties and rising prices in the American coal industry, the principal exporter in the free world;
- rising prices for coal imported into Western Europe;
- supply bottlenecks, threats of shortage and increasing prices in the American natural gas market, affecting the production of electricity in many States;
- shortages and rising prices for heavy fuel oils in the two big consumer areas: Western Europe and the U.S.A.;
- increasing crude oil prices imposed by most oil producing countries, and a growing move in a number of these countries towards the adoption of measures to safeguard the future of their resources;
- a substantial increase in shipping rates.

This booklet seeks first to analyse the present situation and then to identify, as far as possible, the fundamental trends of the world energy market in the medium and long term. It examines the consequences of these developments for Western Europe and outlines the practical policy which will have to be adopted in Western Europe if they are to face these consequences.

Reader Enquiry Service No. **7160**

Warren Spring Laboratory Review 1969-70

This new illustrated Review presents highlights from Warren Spring Laboratory's activities during 1969-70 in the fields of catalysis, control engineering, handling of bulk materials, mineral processing, metals extraction, air pollution and oil pollution of the sea and beaches.

The Review, issued free from the Laboratory, replaces both the annual report series sold through HMSO and the occasional illustrated brochure on the Laboratory and its services. In text and illustrations the review emphasises the relevance of the work to the needs of industry. In addition to brief accounts of developments in each of the main fields of in-house research the review presents for the first time a brief statement of earnings and expenditure, a list of extramural research contracts placed by WSL, and a partial list of sponsors who have used the facilities and expertise of the Laboratory during the period under review.

Reader Enquiry Service No. **7161**

Science and Survival
Barry Commoner. Ballantine Books. 40p.

"The price of pollution could be death" is the frightening message contained in Dr. Barry Commoner's book.

Commoner warns against the dangers we face from new scientific technologies which have harmful long range effects on our environment and threaten our very existence. He examines in detail the role of the scientist and citizen in safeguarding the future. "We are in a period of grace", he says, "we have perhaps a generation to save the environment from the final effects of the violence we have done to it". His book is an eloquent plea to every person to join in the task of safeguarding mankind. But—perhaps he has rather overdrawn the picture, and as a result he has weakened his case.

Reader Enquiry Service No. **7162**

Determination of Phosphorus in Solid Fuels

BS 1016 Analysis and testing of coal and coke, Part 9, Phosphorus, was first issued in 1960, giving methods for obtaining a solution of the phosphorus in a fuel sample and completing the determination either volumetrically or colorimetrically. Although alternative methods of solution, either by wet oxidation or by acid treatment of fuel ash are still in use, the volumetric method is seldom employed to complete the determination of phosphorus, and has therefore been omitted from the revised Part 9 now published. The methods for the determination of phosphorus are also in line with those adopted by the International Organization for Standardization as International Recommendations.

BS 1016, Part 9 may be obtained from the BSI Sales Branch at 101 Pentonville Road, London N1 9ND. Price by post 60p (subscribers 50p).

Reader Enquiry Service No. **7163**

Measurement of Grit and Dust Emission

Work on BS 3405 Simplified methods for measurement of grit and dust emission was begun on the recommendation of the Beaver Committee and published in 1961. However, it has been discovered that changes since then in industrial and domestic practice (and in Government legislation) have highlighted certain limitations in the use of the assemblies described. To ensure that it can be adopted as a reliable guide for the measurement of grit and dust emission a revision of the publication has been completed which incorporates a substantial change in emphasis.

The earlier issue contained detailed descriptions and instructions for the use of five apparatus assemblies which were believed to to be satisfactory. In the new edition reference is still made to the latest available models, but responsibility is placed on the suppliers to ensure that instructions are available so that the test can be carried out correctly with any particular apparatus. It may be possible to provide an approval scheme at a later date, but in view of the urgent need to put forward a revised version of the test procedure, it was considered undesirable to delay the re-issue of the standard while investigations in this direction were being conducted.

BS 3405: 1971 may be obtained from the BSI Sales Branch, 101 Pentonville Road, London, N1 9ND. Price by post 85p (subscribers 70p). Remittance with orders to non-subscribers.

Reader Enquiry Service No. **7164**

International Youth Federation for Environmental Studies and Conservation. Report of the International Youth Forum for European Conservation Year 1970

The International Youth Forum for European Conservation Year was convened by IYF, in consultation with the Council of Europe, from the 13-25 July, 1970. The representatives of European youth reviewed the problems of the environment and discussed the role that young people can play in their solution, as well as considering the results of the Strasbourg Conference. The main task of the Forum was preparatory work for the World Youth Assembly of 1971 and The United Nations Conference on the Environment in 1972.

The Report gives the declaration and proposals of the Forum and goes on to describe the objectives and activities of the International Youth Federation, giving the programme for 1970-71. A list of publications and details of membership of IYF are also given.

The idea, preparation and activities of the Forum are then given in detail, with a list of participants. Appendices are given of the lectures and other reports on various aspects of pollution control and conservation given during the Forum.

The Forum concludes that the youth of today are ready to make sacrifices for a better environment in the future and are determined to effect positive policies and actions to conserve the environment and its natural resources on a world wide scale.

Reader Enquiry Service No. **7165**

The 37th Annual Report of the Electric Vehicle Association of Great Britain Ltd.

The report shows that 1970 was another successful year for the Association. Approximately 3,022 new battery electric vehicles were registered during 1970. These figures include industrial vehicles as such but do not include those vehicles used in industrial or hospital service on private property. Electric industrial trucks manufactured during the year showed an increase of 15 per cent and the number exported was also increased.

A vigorous programme of promotions for electrics was carried out embracing Press advertising, editorial publicity, a brochure, an international exhibition and a demonstration of electric road vehicles and industrial trucks.

Reader Enquiry Service No. **7166**

Reader Enquiry Service No. **7167**

AIRBORNE PARTICLES

Veterinary officer, Glorgio Preziosi has found that Milan's dogs have a life expectancy one-third shorter than the 17-20 year average elsewhere in Italy and he blames air pollution. He explained that dogs tend to inhale more toxic fumes from car exhausts than human beings because their noses are closer to the ground. Milan's major newspaper Corriere Della Sera, has warned that for the same reason, children are more severely affected by carbon monoxide pollution than adults.
Gloucester Citizen 19.3.71.

Canadian National Railways has introduced a vehicle pollution control programme to monitor the exhaust emissions of about 1,000 of its trucks in Ontario and Quebec. The railroad is installing at these two centres testing equipment, including rolling roads and exhaust analysis equipment. The results will help the Ontario Government and other government bodies to establish official exhaust emission standards.
Motor Transport 26.3.71.

A vehicle believed to be the first in Cumberland to be converted from petrol to liquid gas, a non-taxable fuel, made its debut in Carlisle yesterday. The conversion to liquified petroleum gas offers a 50 per cent cut in fuel costs, less engine wear, and a tremendous reduction in fumes and smoke pollution. The converted vehicle was seen for the first time today in a fleet vehicle owned by Cavaghan and Gray, the Carlisle firm of bacon curers, at the London Road premises. The fuel conversion, on a two-ton Commer commercial van, has been developed by the firm's transport manager Mr. Jack Byers, along with Mr. Alan McKenzie, of McKenzie's Ltd., Carlisle, who carried out the conversion work.
Cumberland News 26.3.71.

The Italian Senate has approved a draft law whereby all the new automobiles in Italy will have to be fitted with a special device reducing the carbon dioxide of the exhaust to 4·5 per cent and its hydrocarbons content to 0·15 per cent (this latter refers to the total quantity of fuel consumed by the car). If approved also by the Chamber of Deputies, the new law will go into force on 1 October.
Chemical Age 2.4.71.

Scientists are using an atmospheric sampling programme to build a library of pollution "fingerprints" that eventually may be used to tell where an offending particle comes from, where it goes, and how long it remains in the air. The project is being carried out jointly by scientists from the Los Alamos Scientific Laboratory and the Air Force under the readiness programme originally used to track down debris from atmospheric nuclear testing. Since atmospheric nuclear tests have been banned by treaty, the scientists are checking other kinds of pollution.
Christian Science Monitor, Boston 1.4.71.

Public Health Inspectors who investigated "a continuous emission of black smoke" from a Warley scrap dealer's premises found it was coming from a storage tank. The scrap dealer told them that the tank had accidentally ignited whilst he was cutting it up for scrap. He was advised to call the fire brigade, but when the inspectors returned to the site later they found the tank still smoking. This resulted in John Arthur Bishop of Wrights Lane, Old Hill, Warley, appearing before the magistrates at the Old Hill Court charged with emitting dark smoke contrary to the provisions of Section 1 of the Clean Air Act, 1968. Mr. M. R. Neale, solicitor to Warley Corporation, prosecuting, said that the fire had been caused through some residue in the bottom of the tank. An experienced scrap dealer should have known that the appropriate action was to steam clean the tank before cutting it up. Bishop, who pleaded guilty, was fined £10 with £4 costs.

Pollution alarm devices will be installed in two long underpasses in Rome, the city's health and sanitation department has announced. The department said the danger from exhaust fumes when traffic jams built up in the tunnels made the alarms necessary.
Eastern Evening News 1.4.71.

West Germany's largest power company has promised to produce a prototype electric car by 1975, and provide a network of service stations to provide fresh batteries. The Rheinisch-Westfaelische Elekrizitaetswerke (RWE) has announced the formation of two subsidiaries to handle the development of electrically-powered vehicles and a supporting network of service stations respectively.
Financial Times 13.4.71.

Crewe, Cheshire, Town Council's Finance Committee has been told that the cost of implementing a smoke control order for 231 houses rose by £3,309 to £12,549 in three years. It was stated that the reason for the increase was that tenants were given a wider choice of heating appliances and over half the excess costs were due to higher gas fire fixing charges.
Solid Fuel 31.3.71.

New York City will soon have the first large-scale waste disposal plant in America that will not pollute the air. It will destroy refuse and industrial waste by baking instead of burning. The installation will be capable of baking 1,000 tons of refuse a day after it has first been through shredders capable of ripping up cars, furniture and refrigerators. Baking converts most of the refuse to gases, with only about 5 per cent of the original bulk left. The gases are then broken down to non-toxic gases before being released into the atmosphere.
Daily Telegraph 22.2.71.

INDUSTRIAL NEWS

New Oil-fired Boiler

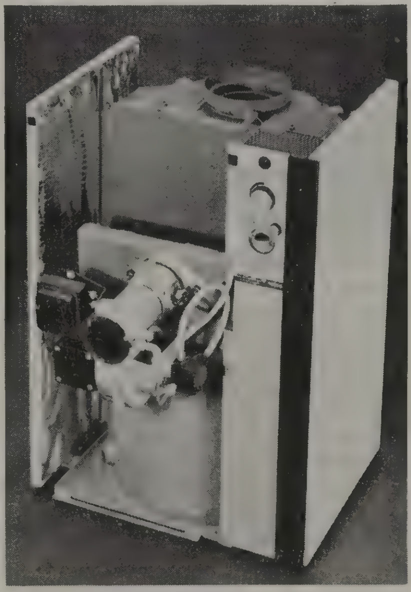
With a simple switch of nozzle and adjustment of the air supply the new oil-fired boiler just being introduced by Redfyre Ltd. will give 18 kW (61,400 B.T.U./hr.), 22 kW (75,000 B.T.U./hr.) or 28 kW (95,500 B.T.U./hr.). A fully automatic down-firing pressure jet, the new Centrajet 18/28 is supplied complete and ready for installation in a single carton.

Changing output is simple. The burner (the B.O.B. Selectors D 42) with the fan, motor and oil pump are mounted on a plate which is secured by two nuts and hinged so that the complete assembly can be swung from the down-firing into the horizontal position. The nozzle is thus immediately accessible and can be unscrewed with a box spanner and replaced with the size appropriate to the required output. When the burner is returned to its normal down-firing position the air slide is adjusted with the knurled screw and re-rating is complete.

Only one other adjustment may be needed on site. The appliance is designed to burn 28 sec. kerosene (class C fuel) or 35 sec. gas oil (class D fuel). All burners are tested on the latter at the works so are dispatched with the oil pump set for this fuel. If the appliance is to burn kerosene the pressure must be adjusted with the screw on the side of the pump.

With the thermostat as the householder's main control the boiler incorporates a control box which plugs into a socket within the control chassis and is programmed with a light-up and shut-down sequence operated by electro-thermal relays. A safety lock-sequence is also included. Ignition is by a 10,000 volt spark arcing across electrodes which are fitted behind the nozzle, the air flow down the blast tube curving the spark forward to ignite the atomised fuel at the flame ring.

Initial switch-on energises the electrodes and starts the motor which operates the fan and the oil pump, thus creating the correct conditions for complete ignition as the fuel leaves the nozzle. The burner fires downwards into a large combustion chamber which permits full flame development and is water-jacketed at the sides and base. A small mild steel plate, fitted about 1 in. above the floor of the chamber, prevents direct flame impingement on the base, eliminates the need for refractories and provides a hot surface to ensure complete final combustion. A photo-electric resistor in the blast tube switches off the ignition as soon as flame is established and the boiler remains at high fire until the thermostat is satisfied. The appliance then switches off and remains shut down until the thermostat again calls for heat.



Neat and compact the boiler stands 900 mm. (35½ in.) high, 610 mm. (24 in.) wide and the overall depth is 520 mm. (20¾ in.). All models will be despatched to merchants fitted with the 22 kW (75,000 B.T.U./hr.) size nozzle. The 18 kW and 28 kW sizes will be available to stockists in a separate pack containing six of each size and free replacements will be supplied for each 22 kW nozzle returned to the company. Since the appliance can easily be re-rated to meet the demands of a variety of different systems it helps save space in the merchant's warehouse.

Simple to install and service, good looking and efficient, the Centrajet increases the scope of Redfyre's range of automatic oil-fired boilers which are capable of providing full central heating and domestic hot water for homes of widely varying sizes. The new appliance is in production and is available for delivery now. The basic boiler will retail for £137; including casings the price will be £143 and the boiler with both casings and programmer will sell for £149.

Reader Enquiry Service No. **7169**

New Gas Information Service

An information library dealing exclusively with gas installations in the commercial sector of the market has been established jointly by the Gas Council and Area Gas Boards.

The Commercial Technical Library of Information, housed at the Gas Council's Watson House research station at Fulham, operated for four months on a closed circuit basis for use by Area Boards. On 1 February, 1971, the service became generally available to the engineering and architectural professions and heating trades.

The library already comprises more than 400 case histories supplied by Area Boards, plus information provided by equipment manufacturers. Details of interesting and unusual installations are continually being recorded and, in addition, the commercial library can draw on the resources of the many other technical and scientific information services maintained by the Gas Council.

The library will operate on a 24-hour basis through an ansaphone service (Telephone 01-736 7445). For speedy and comprehensive retrieval of information, the library employs a co-ordinate index system, with data recorded on punched cards. It is intended that under normal circumstances an enquiry will be answered within 48 hours.

Coal Prices

After consultation with the Industrial and Domestic Coal Consumers' Councils and with the agreement of the Government the National Coal Board announce increases in the prices of industrial and carbonisation coals, coke and most domestic fuels.

These increases are made necessary mainly by the continuing high level of inflation which is affecting the coal industry. Subject to any developments outside the Board's control during the year, these increases should enable the Board to meet their obligation to break even during the financial year and to avoid an accumulated deficit in excess of the statutory limit.

The price increases will raise about £70 million of additional revenue in 1971/72.

In most coalfields the price rises will be about 11 per cent for industrial coals and about 16 per cent for carbonisation coals.

Because of the relatively lower costs in Yorkshire and the Midlands, the price increases for such coals produced in these coalfields will be confined to averages of 6 per cent on industrial and 11 per cent on carbonisation coals.

The increases applied from April 13, 1971. The large tonnage of industrial coal mined in Yorkshire and the Midlands means that the average price increases for industrial and carbonisation coal is about 8 per cent.

The Board have decided to defer increases for domestic fuel until July 1 so that trade and retail customers can benefit from the introduction of lower summer prices. The Board's prices to merchants will be subject to a discount of £1·25 a ton from May 1 to September 30. So consumers will be able to buy in stocks for next winter from May 1 to June 30 at the old summer prices saving up to £2-£3 a ton on the retail prices applicable next winter.

The domestic price increases to the distributive trade are:

	£ per ton	per cwt. (approx.)
Bituminous house coal (all groups)	1.00	5p
Anthracite nuts	2·00	10p
Dry steam nuts	1·60	8p
Sunbrite	1·95	10p
Multiheat	1·65	8p
Phurnacite	1·65	8p
Roomheat	1·65	8p

There will be no increase in the prices of Homefire or in the small sizes of anthracite used in gravity feed appliances.

Reader Enquiry Service No. **7170**

Gas Fired Central Heating Helps Rescue Older Homes

An enterprising scheme to show how older properties, which although soundly built, lack many of the basic modern amenities, is to be mounted by Radiation Parkray Ltd. in co-operation with Bristol Corporation.

Basis of the scheme is a 60-year-old property at 71 Sandholme Road, Brislington, Bristol, which has been brought up to date by means of the discretionary grants made available in the 1969 Housing Act. (The 1969 Housing Act authorised larger grants for the modernisation of older and sub-standard properties).

The two-bedroomed terraced house at 71 Sandholme Road is one of 50,000 privately owned properties in Bristol eligible for grant. Bristol Corporation have already designated three areas in Bristol as General Improvement Areas, and have opened showhouses in these areas to the general public. The showhouse at Sandholme Road, however, is the first time that the Corporation have tied-up with a central heating manufacturer, to focus attention on this aspect of home improvement.

Major repairs and improvements to the property include the installation of a Parkray 401 gas fired central heating system by Radiation Parkray Ltd., damp proofing, felting and re-battening the roof, the fitting of a modern kitchen with a new sink and built-in cupboard, re-wiring throughout the house, repairing and renewing windows and renewing the first floor ceilings, and decorating the property throughout.

Plans for the house were drawn up by the Corporation's Housing Department, and the main contractor was F. J. Cantle of Bristol. Installer of the Parkray gas fired heating system was Everwarm Homes of Bristol.

The Parkray 401 system is installed in the living room of the house, and replaces old-fashioned open fires in the living room and lounge. The 401, Parkray's elegant new gas fire fronted back boiler system, feeds seven radiators sited in each of the two bedrooms the bathroom, the hallway, the kitchen and two in the lounge.

Bristol Corporation have had many years' experience with Parkray systems. On their local authority pre-war improvement scheme Parkray solid fuel units are specified as standard, although other systems may be chosen at additional cost, and last year 80 per cent of the council's tenants opted for the Parkray system.

Reader Enquiry Service No. **7171**

The C & N Heat Regenerator for the Recovery of Exhaust Heat

The recovery of up to 80 per cent of exhaust or waste heat is possible, by using this unique heat exchanger, which exchanges both the sensible and latent heat with very high transfer efficiencies.

The regenerator is designed to recover heat from air which must be exhausted because of contamination by smoke, chemicals, fumes or odours, or when it is exhausting with a high moisture content from process drying plant. It will return this heat to the fresh incoming air supply.

The heat regenerator is simple in construction, and needs very little maintenance. It consists of a rotating wheel mounted in a specially designed steel frame, which can be fixed vertically or horizontally. The rotor is made of segments of heat transfer media, usually knitted wire mesh, which has little resistance to the air flow.

The heat transfer media obtains heat from the exhaust contaminated air and holds it until the wheel rotates into the fresh incoming air stream, where the heat is given up. As the wheel is continuously rotating during the period of exhausting, the heat transfer is an uninterrupted process. Fuel costs on an existing installation can, by recovery for re-use, be reduced by up to 80 per cent of wasted heat.

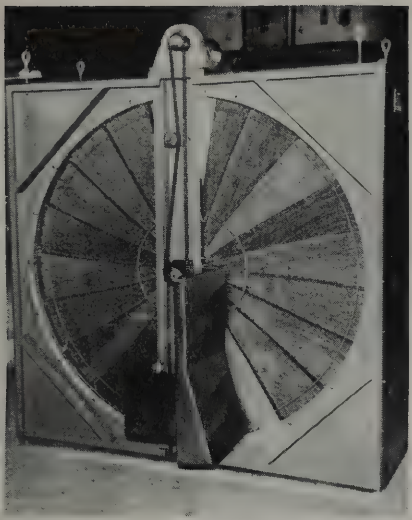
Where the exhaust gases contain contamination, a special scavenger device can be fitted and cross contamination then controlled to less than 1 per cent by volume. A simple and effective method of safeguarding air purity.

The regenerator can be used for heat recovery in conjunction with building ventilation, process exhaust, drying processes, food processing, ovens, kilns, foundries chemical plant, hospitals, fume and odour control. Recovery of cool air from air conditioned buildings or refrigerated areas, is the reverse process thus providing a supply of pre-cooled fresh air.

Whether or not a specific project is practicable depends upon the volume and temperature of the air being exhausted, hours of operation, cost of fuel or energy and make up air design conditions.

Standard models of the regenerator are provided with aluminium rotor and suitable heat recovery media. For installations where acid or other noxious chemicals are held in the exhaust gases, they have stainless steel rotor and stainless steel media.

Aluminium rotor and media are suitable for gases Ph7 or lower, and to 400°F (average hot side). Units



with steel rotor and stainless steel media, are suitable for Ph7 or higher and/or 280°F (average hot side). Stainless steel rotors and stainless steel media are available for Ph7 or higher and/or to 800°F (average hot side). A special unit can be used for temperatures up to 1500°F.

The heat regenerator uses the Ljungstrom principle which in the past, has been extensively used in large generating plants, recovering heat from combustion gases. In its present form, the regenerative type of rotory heat exchanger has been in the U.S.A., and Canada for a period of about 10/12 years.

The pressure drops across the regenerator will vary from ·5″ to 1·5″ with face velocities 500ft per minute to 900ft per minute. The pressure drop and face velocities are a matter of design.

The heat regenerator will prove to be of special interest to users of electrical heating. These users will be quick to realise the high cost of exhausting warm air. Industrial high temperature applications result in much greater savings, but each application will have to receive careful consideration if dew-point problems are to be avoided.

For larger installations twin regenerators are also available and these consist of two "wheels" in a common frame. These units are capable of handling very large volumes of exhaust and fresh air and consequently the recovery on the capital investment is much quicker.

The primary function of the Unit is to reduce the initial capacity of mechanical equipment required for new installations, processes or extensions. With existing installations the use of heat regenerators can cut operating costs considerably. The recovery of capital outlay can be as quick as 1 to 2 years, representing 100 per cent recovery, plus 30 per cent return on the investment over a 3 year period.

Reader Enquiry Service No. **7172**

Refuse Incinerator Opened at Bolton

The new Refuse Disposal Plant opened at Bolton on 19 January, 1971, is expected to be, on the basis of cost per ton of refuse incinerated, the most economic of its type yet to be constructed in this country. The new plant, the main contractor for which was Redman Heenan-Froude Limited of Worcester, has been completed in less than two years from the signing of the contract.

The plant is situated on an industrial estate in the County Borough of Bolton and is central for the area to be served which includes Farnworth B.C. and Kearsley U.D.C. comprising an initial population of 200,000 with a quantity of refuse from industry. The plant has a single Heenan-Nichols continuous grate with a capacity of 16 tons per hour and will operate initially on a two shift system, with the third shift in reserve to cater for future expansion.

An enclosed six bay vehicle tipping hall feeds the 2,000 cubic yard storage pit from which refuse is transferred to the furnace feed chute by crane with an electro-hydraulic grab controlled by an operator in a high mounted fixed air-conditioned cabin. The operator has unobstructed views of the whole of the pit and furnace feed chute and also indicates vehicle tipping positions by means of signal lamps.

When refuse falls to a low level in the feed chute a detector operates warning lamps in the crane cabin and the main control room. After two minutes, if the refuse level has not been restored, a chute sealing door closes automatically. The two primary fans providing under grate air to the furnace, draw dust laden air from the crane building and a secondary air fan takes its supply from grilles around the feed chute to provide dilution of the gases above the fire in the furnace. The Heenan-Nichols grate consists of four separate banks each 11′ 3″ long × 10′ wide, which are inclined at 11° with vertical drops between each bank. The grate propels refuse down the slope by the rocking action of alternate rows of teeth and power for grate operation is supplied from hydraulic cylinders which are mounted externally on the furnace structure to give ease of maintenance.

Combustion gases from the incinerator pass through a vertical up-flow conditioning tower where a fine water spray cools the gases to a temperature acceptable to the electrostatic precipitator. The electrodes of the precipitator are periodically mechanically rapped and the collected solids fall to discharge hoppers beneath. The efficiency of the precipitator is 96 per cent. Collected solids from the tower and precipitator are carried by water to the clinker discharge system, the water being filtered and re-circulated.

The ash and clinker from the grate are deposited into a quenching water trough. A scraper conveyor is installed in the trough to carry the residuals on to a rubber belt conveyor which lifts them to an overhead storage bunker with a capacity of 100 cubic yards. The conveyor passes beneath a magnet which extracts ferrous metal for pressing in a scrap baler. The storage bunker discharges into a lorry by means of a plate conveyor controlled by the lorry driver.

The control and instrumentation room for the furnace and gas cleaning plant is at the end of the furnace and two heat-resistant windows permit observation of the conditions within. Normally the grates operate on automatic control but the furnace operator can operate them by hand if the conditions warrant it. Tannoy communication from the control room covers the various operating divisions around the plant.

The main buildings of the plant are steel framed, with the lower walls in brickwork and the cladding above in colour coated steel. Areas of vertical glazing give natural light in most areas of the plant. Offices, stores and amenity facilities for plant building which also contains a paper baling plant to handle separately collected paper. A screen with a sorting section lifts the paper to a continuous baler with mechanical handling to a road vehicle.

The chimney for the plant is constructed in brickwork with firebrick lining and is 200′ high. The smoke density meter in the chimney is monitored in the main control room.

Reader Enquiry Service No. **7173**

Study of Traffic in Camden

Mr. Chen Chu, a traffic engineer of the London Borough of Camden, has been appointed a Centre for Environmental Studies Fellowship. Mr. Chu will be undertaking a 6 months investigation of the environmental effects of traffic, and hopes to devise a method of detailed cost/benefit studies for Camden.

Reader Enquiry Service No. **7174**

Directional Deposit Gauge

Mr. N. Smith, a senior Public Health Inspector of the London Borough of Waltham Forest, concerned about atmospheric pollution, had the idea of producing a directional deposit gauge in plastics based on a design used by the Central Electricity Generating Board, so he took his thoughts and sketches to National Plastics Ltd. whose main factory is situated in the same borough. There, in conjunction with the development engineers, a final and practical design was developed using components and pipe from the ‘Series Ten’ 4 in. diameter U.P.V.C. soil system (Fig. 1) marketed by Celanese Building Components Ltd.

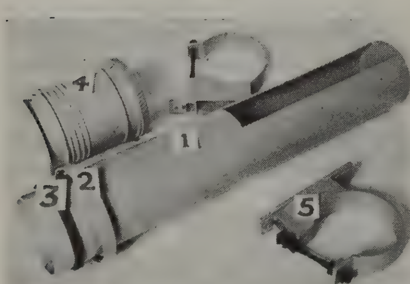


Fig. I

The equipment consists of (1) a main body incorporating a 12 in. × 2 in. opening; (2) a fixed clamping nut; (3) natural rubber multi-vane seal; (4) specially fabricated assembly container which screws into the fixed clamping nut No. 2; (5) fixing clips. Using some of the components a spare container with screw lid is also available.

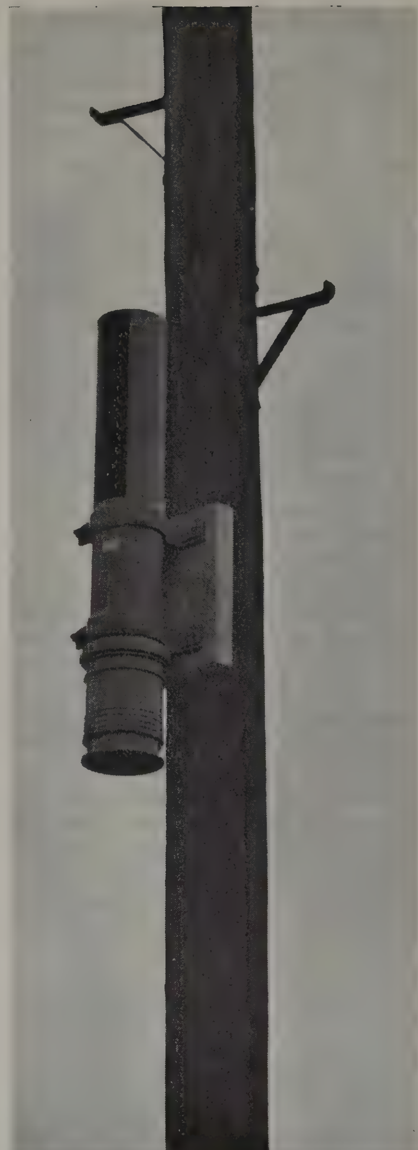


Fig. II

Fig. 2 shows such a directional gauge fixed to a telegraph pole (by permission of the Posts & Telegraphs Department) and collects samples of air which, when washed out on to filter paper, can easily be used to gauge, by visual appearance, the increase or decrease in atmospheric pollution.

Such gauges can be set up in a group facing the cardinal points to ascertain the general direction of a source of pollution or encircling an area to pinpoint the source so that remedial action can be taken to abate any nuisance.

The gauge is available from Finch-Froy Ltd., Barkingside, Ilford, Essex, quoting reference P.124, and costs £1·82 complete. Extra containers with screw caps 90p each.

Reader Enquiry Service No. **7175**

Electricity Most Popular for Central Heating

Electricity was easily the most popular central heating system to be installed in the October/December quarter of 1970, according to figures just released by AGB Home Audit.

Of the total central heating acquisitions, electricity accounted for 46 per cent, gas 35 per cent and solid fuel and oil each 9 per cent. Corresponding percentages for the last quarter of 1969 were electricity 37 per cent, gas 41 per cent, solid fuel 13 per cent and oil 7 per cent.

Electric storage radiators, which have increased their sales every year since they were introduced to the domestic market in 1962, were easily the largest selling single central heating system with 39 per cent of the total market, more than twice as much as the next popular system, gas independent boilers, which accounted for 16 per cent.

Reader Enquiry Service No. **7176**

Cokeoven Process Offered by Allied to cut Pollination

Allied Chemical Corporation believes it has a cokeoven process which will go a long way toward alleviating air pollution surrounding coke manufacture. The New York firm has developed a pipeline charging system which it claims has the potential of reducing smoke and gases from by-product cokeovens by as much as 70 per cent.

Operation of cokeovens has long been one of industry's most difficult environmental problems. Opening of cokeovens to recharge them with coal and to remove finished coke releases dense clouds of smoke. But Allied's charging system employs closed pipelines to transport pre-heated coal into the ovens. A pilot installation is operating at the company's Ironton, Ohio, plant.

Initial results from the Ironton battery reveal a drastic reduction in air pollution, accompanied by an increase in coke production by as much as 50 per cent.

Allied and Salem Corporation, Carnegie, Pa., have set up Coaltek Associates, a partnership of affiliates of Allied, Salem and Gibbons Dudley Ltd., of Britain, for the purpose of licensing the new method for pipeline charging of cokeovens with pre-heated coal.

The Ironton pre-heater is the first commercial installation of this type of equipment. The process is said to be applicable to both existing and new by-product cokeovens.

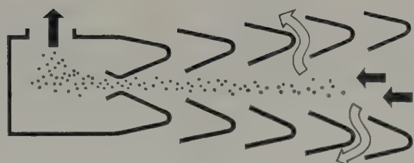
Inertial Separator Saves 66 per cent Space and Reduces Cost in Dust Separation Plant

The use of an inertial separator in a dust-separation system has made possible a plant that occupies only one-third the space conventional plant would require while considerably reducing the capital cost. The inertial separator is a GKN Farr Filtration Ltd six-cell Dynavane unit used in a dust-separation and collection plant supplied and commissioned in 1970 by the Midland Fan Co. Ltd. for the Triplex Safety Glass Co. Ltd. of Birmingham.

A GKN Fair Filtration Single Dynavane Cell

The plant is associated with the production of laminated safety glass for the motor industry, in which sheet plastic in strip form is used as the laminating material. The dust is finely powdered sodium bicarbonate used by the plastic manufacturer on the faces of the strip to prevent them sticking together when rolled for storage or transit.

As the rolls are unwound for processing, the strip is lightly brushed on both sides freeing the greater part of the sodium bicarbonate. The powder-laden air is then extracted and ducted to the dust-separation plant. With the winding machines working to full capacity an air extraction rate of 10,500 ft.^{3}/min. is required. With a conventional bag filter/settling hopper system alone it would have required plant taking up space of the order of 17 ft. × 7·5 ft. × 11 ft. 8 in. high and larger bag filters to cope with the capacity.



Dust-laden air enters the cell at the wide end and travels at speed towards the narrow end. In the process approximately 90 per cent of the air is forced out via the vanes (as the outline arrows) while most of the air-borne particles continue in a straight line (as the solid arrows) into a bleed duct at the apex of the cell and are carried away by the remaining 10 per cent of the air

This would have taken up far more space than Triplex wanted and to meet this space-saving requirement Midland Fan included the Dynavane in their design. The compact six-cell Dynavane (excluding the bleed pipe and pump, it only takes up 2 ft. 6 in. × 2 ft. 6 in. × 2 ft.) can handle a volume of air up to 10,500 ft.^{3}/min., removing 90 per cent of all dust particles of 5-micron size and larger from the main stream and leaving it acceptably clean for discharge to atmosphere. The main stream accounts for 90 per cent of all the air: the remaining 10 per cent—with the 90 per cent of the dust particles of 5-micron size and above—is bled off and passes through the bag filter settling hopper installation before being discharged to atmosphere.

Reader Enquiry Service No. **7177**

Yugoslavia Sending Air Pollution Delegates to U.K.

The City Assembly of Sarajevo, Yugoslavia are proposing to send a delegation to various European cities to investigate how air pollution is tackled, and U.K. firms who are expert in the field of air pollution and who are interested in being employed as a Consultant should contact: Ing. Branko Milutinovic, Potpresednik, Skupstina Grada Sarajevo, Sarajevo, Yugoslavia.

Industrial Company Starting Environmental Division

Norsk Spraengstofindustri A/S, Tollbugt 22, Oslo 1, Postboks 779, Norway, are forming a new Environmental Division and would be pleased to make contact with any English manufacturer who requires Agents/Representation in the environmental industrial field in Scandinavia. Anyone interested should contact Mr. Paal Buset at the above address.

Thermotank Products Expands Uses for Cooling Tower Fill

The agreement has been announced between Aktiebolaget Carl Munters of Fack Sollentuna 1, Sweden, and Hall-Thermotank International Ltd. for sole manufacturing rights in the United Kingdom of a patented "cross-flute" configuration of high quality rigid vinyl sheet for use as a cooling tower fill and other applications.

Manufacturing and marketing will be undertaken by Thermotank Products, a division of Hall-Thermotank International.

The agreement now permits the direct sale of the Thermotank range of cooling towers world-wide with the exception of the Scandinavian countries and the Argentine.

The new agreement also enables Thermotank Products to sell fill material in the United Kingdom for any alternative application.

The "cross-flute" material has been used exclusively as a fill in cooling towers manufactured by Thermotank Products since it was introduced to the U.K. three years ago. Manufactured in the U.K. by Thermotank Products, the fill is exported to Hall-Thermotank companies in South Africa, Australia and New Zealand for use in locally-manufactured cooling towers.

The "cross-flute" configuration comprises a series of diagonally-opposed channels incorporating a corrugated construction forming ridges. The design utilises exposure of the maximum wetted surface to the induced air flow, creating high heat-transfer efficiency.

Formed from high-quality rigid vinyl sheet which is resistant to most corrosive chemicals at high concentrations, the material has high physical strength, when formed into pads or packs, with the added advantage of long service life.

Reader Enquiry Service No. **7178**

Nusoil Plant for Iran

Nusoil Ltd., a member of the International Combustion Group of Companies, has won a £1,800,000 contract to supply a complete composting plant to Iran. The order, which has been placed by the Municipality of Teheran, is to be financed by a long-term credit backed by the Export Credits Guarantee Department. This is a major overseas contract for Nusoil's revolutionary process which combines the effective disposal of domestic waste with simultaneous production of humus for compost. Mr. T. Henry Turner mentioned this process at the Southport Conference (Part II Conference Papers page 36).

Reader Enquiry Service No. **7179**

Reader Enquiry Service No. **7180**

Curtains up for ITT Reznor and Progress Jets

ITT Reznor and Progress Jets Ltd. —specialists in air curtains—have reached an agreement which will provide the British gas trade with a service second to none in warm air curtains. The agreement is the result of talks which have taken place over the last twelve months.

The main effect of the agreement is the availability of a range of gas-fired warm air curtain equipment from which can be chosen a 'package' to suit almost any requirements.

ITT Reznor's field team will be looking for suitable applications for warm air curtains, knowing that Progress Jets Ltd. considers Reznor heating and ventilating equipment to be ideal for use in gas-fired installations. Similarly, where Progress Jets Ltd. are able to install air curtains fired by gas, Reznor equipment will be recommended.

The talks between the companies were conducted by Vic Bensen, ITT Reznor UK general manager, and H. P. Creek—a director of Progress Jets—since early 1970, and already a number of installations are under way.

Reader Enquiry Service No. **7181**

Beaumont Awarded Contract

F. E. Beaumont Limited have been awarded a contract to a total value of £40,000 to remove the three defective moler brick linings from the 185 ft. high concrete chimney at Ninewells Hospital, Dundee and to design, manufacture and erect, in substitution, five mild steel liners and horizontal flues, each 1 ft. 9 in. diameter, to serve the boilers. In addition, they will supply and erect a 185 ft. high × 3 ft. 1 in. diameter incinerator liner which is to be fitted with a 2 in. thick refractory lining and mineral wool insulation, complete with an insulated horizontal flue to connect the three incinerators to the liner.

Reader Enquiry Service No. **7182**

Gas Supplies at Record Level

Record figures for sales of gas in the year ended March 31, 1971, are foreshadowed in statistics published by the Gas Council.

In the nine months to December 1970 the industry had already made available 4,160 million therms, an increase of 16 per cent over the corresponding period in 1969. These figures compare with an 11 per cent rate of expansion in the year 1969-70.

Natural gas, in the last quarter of 1970, accounted for nearly three-quarters of the total supplies. The industry purchased 1,380 million therms of North Sea and Algerian natural gas, of which 43 per cent—599 million therms—was piped direct to customers and the remainder used as a feedstock in the manufacture of town gas.

Reader Enquiry Service No. **7183**

Lodge-Cottrell Precipitator for Aberthaw Cement

A contract valued at approximately £70,000 has been awarded to Lodge-Cottrell Ltd., Birmingham, for the design, supply and installation of an electrical precipitator for the cleaning of the cooler end gases of No. 5 Kiln at the Aberthaw Cement Works, East Aberthaw, Glamorgan.

The precipitator is designed to handle 100,000 cfm of gas at 200°C and will be installed following an existing mechanical collector. Emission of exit gases to the atmosphere will contain not more than 0·1 grains/cu. ft. NTP of dust.

Reader Enquiry Service No. **7184**

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CLEAN AIR

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AUTUMN 1971

VOL. 1 NO. 3

PRINCIPAL CONTENTS

PRICE 30p

CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

Vol. 1 No. 3 **Autumn 1971**

Principal Contents

Index to Advertisers

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"This most excellent canopy, the air"

CLEAN AIR

Brakes Off Smoke Control

In a circular issued by the Department of the Environment on the 26th July, the Secretary of State expressed the hope that authorities who during the past two or three years have reduced or discontinued their smoke control programmes, will now resume them energetically. In particular, the Secretary of State is anxious to see good progress in the "Black" areas and he asks that all "Black" area authorities to review their programmes and to see whether more rapid progress can be achieved. The circular continues that "there is no longer any cause for any local authority—"Black" or "White"—to refrain from proceeding with a programme, and the Secretary of State wishes to give every encouragement to smoke control and hopes to receive a large number of orders."

The circular states that the Secretary of State has been advised that the amount of solid smokeless fuel available for the domestic market during the winter of 1971/72 is likely to be a good deal more than the amount sold in 1970/71. This improvement is largely due to planned increases in production by the producers, and given all but an exceptional winter, supplies of solid smokeless fuel seem likely to be fully adequate to meet consumer demand. "It is not expected that there will be any need for the suspension or deferment of smoke control orders. No supply difficulties are expected after the winter of 1971/72."

This is excellent news and the circular makes excellent reading for all those who are interested in the cause of clean air and smoke control. After the doldrums of the last two years when the shortage of solid smokeless fuel has caused not only a deferment of smoke control progress but also the suspension of smoke control orders in areas where they have been in operation for many years, this news comes like bright sunshine breaking through the clouds. It is to be hoped that local authorities will take the opportunity that is now given to them to proceed with smoke control with renewed impetus and energy, and that as a result we shall see an upward trend in the number of smoke control areas coming into operation once more. Although the Secretary of State makes the point that he is anxious to see good progress in the "Black" areas, he also emphasises that there is no longer any cause for any authority, be it "Black" or "White" to refrain from proceeding with the programme. For some time many of those intimately connected with the clean air movement have considered that the time has now been reached when there should be no distinction between the "Black" and "White" areas. Indeed, some of the so-called "White" areas are greyer now than some of the so-called "Black" ones. The Circular gives the first hint that the Department of the Environment is perhaps beginning to think in a similar manner.

In the meantime, it is the clear duty of this Society and all its members to give every encouragement and help to all authorities who will seek to implement the wishes expressed by the Secretaty of State, and if need be, to persuade the more reluctant authorities to take similar action.

The United Nations Conference on the Environment

The Secretary of State for the Environment, Mr. Peter Walker, will lead the U.K. delegation to the United Nations Conference on the Environment which will be held in Stockholm from 5th–16th June 1972. This Conference, which will be conducted at Government level, will be concerned with the human habitat, the control of pollution and the management of natural resources. Its aim will be to make an evaluation of the present state of the world environment, discuss the principles on which future international action can continue and be extended, and, it is hoped, proceed to certain specific agreements.

In collaboration with other Government departments and local authorities, the Department of the Environment will be providing the technical expertise required in the preparation and presentation of the Government's contribution to the conference. Nevertheless, opportunities have been afforded to a wide range of voluntary and private organisations to give their views. Four Working Parties, three dealing with the main items on the Stockholm agenda, have been set up. The Working Party on the control of pollution, which is the one with which this Society is mainly concerned, will be chaired by Sir Eric Ashby who will be opening the Society's own Clean Air Conference at Folkestone on the 2nd November next. Lady Dartmouth is the chairman of the Working Party on the human habitat, that on the management of natural resources will be chaired by Mr. Ralph Verney, and the fourth Working Party which will consider the action that can be taken by young people's and voluntary organisations to preserve and improve the environment will be chaired by Mr. Dennis Stevenson.

The Chairman of these four committees have been free to appoint the members of their Working Parties and also to seek contributions from all those interested people with experience in their specialised fields.

Readers will be pleased to know that the Society were asked very early on for their views on air pollution and that these have been sent to Sir Eric Ashby. Members will also be interested to learn that the Director of the Society has been appointed a member of the Working Party on the control of pollution.

Annual General Meeting

The Society's Annual General Meeting was held on Tuesday, 22nd June and this might be described as a gala occasion. By kindness of the Corporation of the City of London the meeting was held in the historic Guildhall. The beautiful surroundings undoubtedly lent an air of dignity and solemnity to the proceedings, but the beautiful flowers, the glorious gold plate and indeed the very attire of the members—especially that of the ladies, on a glorious summer's day added a note of restrained gaiety.

The meeting was well attended and the agenda was dealt with in a businesslike and expeditious manner. The Annual Report and accounts were accepted and then Sir Kenneth Hutchison, C.B.E., F.R.S., the retiring President, invested our new President Mr. Stanley E. Cohen, C.B.E., known to members as the Honorary Treasurer for the last 14 years, with the Chain of Office of President.

The Annual Public Meeting followed the business meeting and this was again very well attended. The address was given by Lord Molson, the Chairman of the Committee for Environmental Conservation and his address is reproduced in full later in this issue. Before Lord Molson spoke, the Rt. Hon. the Lord Mayor of London, Sir Peter Studd, welcomed those present and his welcome is also reproduced later in this issue.

After the public meeting the Corporation of London very kindly entertained the members of the Society and guests to a buffet luncheon in the Livery Hall and Crypt. This was a most enjoyable occasion and one which will be long remembered by all those who were fortunate enough to attend.

We welcome Mr. Cohen in his new office as President, but at the same time would like to take this opportunity of publicly expressing our gratitude to our retiring President Sir Kenneth Hutchison. In his two years of office he has done much to benefit the Society and to further the cause of clean air. He has accepted all the calls on his time cheerfully and willingly and has been an eminent leader of delegations from this country to international congresses abroad. His wide knowledge of the fuel industries, with which he has been associated for many years, has been of immense value; and last but not least, his unfailing sense of humour has often provided a tonic when it was most needed. We are indeed grateful to him for all that he has done and look forward to a long association with him in the future.

A brief biography and photograph of Mr. Cohen, the new President, appear on a later page.

Chairman of the Executive Council

Dr. W. C. Turner has been succeeded as Chairman of the Council by Mr. Stanley Cayton, M.B.E. In his turn, Dr. W. C. Turner has been elected as Honorary Treasurer of the Society to succeed Mr. Stanley E. Cohen. Mr. Cayton, the Chief Public Health Inspector of West Bromwich, is no stranger to the Society and the clean air movement as he has been a Deputy Chairman for the past four years. He was awarded the M.B.E. earlier this year and is a Chartered Engineer and a member of the Institute of Fuel. We welcome him as our Chairman at a time when changes are taking place in the Government's approach to the whole question of pollution and when changes are imminent in local government which are likely to have repercussions upon the very structure of the Society itself. Those of us who know him, have no doubts that he will prove himself to be an able and wise Chairman.

We are grateful to Dr. Turner for all his work as Chairman during the past two years and as a Deputy Chairman in the previous four years. Now that he has been elected to the onerous and responsible position of Honorary Treasurer of the Society, he will have his hand on the throttle if not on the helm.

Wider Powers for the Alkali Inspectorate

For several years, because of complaints about dust, the Alkali Inspectorate has been called in from time to time by local authorities to advise on the control of grit and dust emissions from processes involving the crushing, grinding, drying, heating and handling of metallurgical slags, pulverised fuel ash, limestone, chalk, igneous rocks, gypsum, china clay, ball clay and china stone. These processes as from the 1st July this year have been scheduled and brought under the direct control of the Alkali Inspectorate. Quarrying and sand and pebble separation are not included, except in the use of dry processes giving rise to dust.

Another change involves the petroleum industry, which has become a major responsibility of the Alkali Inspectorate because of its growth and the diversity of materials and processes involved. This industry is still expanding and its scheduling under "Paraffin Oil Works" was completely out of date. A new class "Petroleum Works", has therefore been introduced and this defines particular operations much more precisely. The scope is slightly extended and covers, amongst other things, the handling, storing and refining of crude petroleum.

The primary smelting of aluminium has also been scheduled by the Order. For some years primary aluminium smelters have been operating in Scotland and they were scheduled under the Scottish Alkali Acts. Hitherto there have been no such works in England and Wales but one is now being built in England and one in Wales has just been commissioned. The Alkali Inspectorate has been involved from the outset in specifying the best practicable means of controlling emissions to atmosphere from these smelters and the new Order will bring them under the statutory control of the Inspectorate.

The Order has also brought under the control of the Inspectorate processes involving the use of di-isocynates and the manufacture and purification of acrylates. Di-isocyanates are used in the manufacture of expanded plastics, and acrylates are used for surface coatings in the production of plastic fibres and textiles.

On the other hand, two processes, one in the iron and steel industry and one in the aluminium industry have been de-scheduled which means that the supervision for these processes passes to the hands of local authorities under the Clean Air Acts. Both of these processes involve types of furnaces in which the technical problems of controlling emissions have substantially been solved.

Subscriptions from Individual Members

Members may recall that in the Spring issue of *Clean Air* the hope was expressed that as many Individual Members as possible would pay their subscriptions by Covenant; but it appears that some members are not clear what this entails.

Those Individual Members who pay income tax at the standard rate, may pay their subscriptions by Covenant, which entails entering into an agreement with the Society to pay the Society a specified sum on 1 April each year for seven years. Because the Society is a registered charity, it can recover the tax paid on such subscriptions from the Inland Revenue. Thus, each member covenanting to pay £3 per year will enable the Society to recover a further £1·63 from the Inland Revenue. Similarly if such a member covenants to pay the Society the sum of £1·83 each year, the Society can recover £1·17 (i.e. the amount of tax paid on £3), so receiving in total the sum of £3 at which the Individual Members' rate of subscription is at present fixed.

The necessary forms of agreement are obtainable from the offices in Brighton.

The Society's Annual Public Meeting at Guildhall 22 June 1971

Welcoming Address by

the Rt. Hon. The Lord Mayor of London, Sir Peter Studd

Mr. President, My Lords, Mr. Alderman and Sheriff, Ladies and Gentlemen—and I am so glad to be able to say "boys and girls": may I at once say what a very great pleasure it is to welcome you all to this Annual General Meeting of the National Society for Clean Air, to the very heart of Civic Government here in Guildhall this day. It is an old proverb that says "the smoke of a man's own house is better than the fire of another's", and it is in such spheres of prevention as air pollution that it is easier by far to preach than to practise what one preaches. The other day I saw a motor car with a sticker in its window which said "Power Stations Pollute"; maybe, but I wonder whether the owner realised that he was contributing his share of pollution through his exhaust pipe. So it is right under our skin, it is very close to the ground, and it is a mighty subject of great importance. That is why I am so pleased to see so many of you here who care for our environment.

It is a special pleasure for me to welcome your new President because he has done so much in this City to preserve it from the worst effects of air pollution. It was he, who, when he was Chairman of the Port and City of London Health Committee in 1955 to 1956, steered a way through so that the City of London was relieved of the worst effects of air pollution. We were, in fact, here in the City, I believe, the first to be completely covered by smoke control legislation. Over a year before the Clean Air Act of 1956 came into force, the Corporation had prohibited the emission of smoke in the City by virtue of the City of London Various Powers Act of 1954, and it was you, Mr. President, who pioneered that and drove it through; and it is appropriate, that now, so many years afterwards you should find yourself in this great chair of this highly responsible meeting.

The Health Department of the City of London daily measures the amount of atmospheric pollution both at Guildhall and Snowhill Police Station; and although there are inevitable fluctuations, it is gratifying to report that the general trend is down—especially in sulphur dioxide content.

The increased number of bonfires on building sites since the dark smoke exemption regulations of 1969 has been causing some concern and I am waiting now for the Common Council to decree that I should drive about the City in my state coach rather than my LM Omnibus.

On a more serious level, some of you will know that I am concerned in plugging the theme of the importance of communications and I dare say that there is quite a lot in this area that you will feel, as a body, is important, so that the public may be fully aware of what you are striving to achieve. I am glad to see that there are areas of communication to which I refer, or think of, as transport rather than the sort of communication that I am concerned with, which is transmission of ideas. But in the transport sense, I am delighted to find that before the end of this decade you will be able to see new railway engines powered by electric or gas turbine adding very little to environmental pollution.

As some of you may have seen on television, I am interested and concerned about the state of the fabric of St. Paul's Cathedral. I have seen what air pollution has done to this and it is very much in my mind that if we can reach the target of £3 million to see that the cathedral is safe in our time, and ensure that it will not be suffering the same pollution as it has done until very recently. I hope that as a result of your work throughout the land, this will go farther and farther afield so that we can breathe fresh air.

May I wish this meeting every success; you will never attain success very quickly, but I believe that when as many as you who care are gathered together to consider, what does need to be done, the timing is now right, I think that everyone is beginning to understand that we have got to preserve our environment. Clean air and air pollution are right at the heart of this problem as we breathe air every day of our lives. We are appalled now, at last, by some of the detriment that can result if we do not do something about it.

Mr. President I have spoken for too long, but I do wish this meeting every success and I hope that the spirit of it will go out throughout the land; it is very vital for our own future, but more especially for our children's grandchildren's future.

CoEnCo and Clean Air

by

Lord Molson

Chairman of the Committee for Environmental Conservation (CoEnCo)
Address to the Society's Annual Public Meeting at Guildhall, London
on 22nd June 1971

Mr. President, My Lords, Ladies and Gentlemen, I am naturally very much gratified at being asked to address this Annual Open Meeting of the National Society for Clean Air. This Society is one of the oldest voluntary organisations concerned with the environment. It is very natural that this should be so. One of the first forms of pollution that resulted from the Industrial Revolution was the darkening of the skies and the fouling of the air by the burning of coal in order to generate power. So all-pervading and so unpleasant was this pollution that the Alkali Inspectorate was created as early as 1863; that is a very remarkable fact, for in Mid-Victorian times any form of control by the government was regarded not only as unnecessary but almost as immoral as interfering with free enterprise.

It is again because of the obvious disadvantage of air pollution that one of the first Acts of Parliament against the smoke nuisance was the Clean Air Act of 1956. It was planned and carried through by my friend beside me, Lord Brooke, who was then Minister of Housing and Local Government. Public opinion at that time was not so worried about pollution as it now is and I hope that Lord Brooke's foresight, imagination and courage are properly appreciated now, despite the fact that measures of that kind are much more popular now than when he carried it through.

Ladies and Gentlemen my presence, as you Mr. President have said, is due to my being Chairman of the Committee for Environmental Conservation. Now that is a most forbidding title, but a title should accurately explain itself and ours does. We tried very hard to avoid the word Environment, but it was the only word to include all kinds of pollution. Indeed, when I consider how long I and my friends took in trying to avoid the word Environment it came as some comfort that many months later the present Prime Minister looking for a name for the all-embracing Department was obliged to use the same name we had chosed.

Our membership includes, of course, your Society; because nothing is more obviously part of our environment than the air we breathe. We include also the Noise Abatement Society because noise in this 20th Century and Technological age is a pollution of our environment which not only impairs our enjoyment of life, but is now known to effect our health and of course particularly our hearing. 90% of boiler makers who have been engaged in that industry for more than 10 years are seriously deaf. We are deeply concerned about the urban dwellers whose lot and surroundings we want to improve. The Civic Trust, founded and directed by my old colleague Mr. Duncan Sandys has done a tremendous amount in this sphere and is therefore one of our members. The environmnet includes mankind in all his manifestations, habitats and interests, and so we include also the Ramblers' Association who have done so much to facilitate people from the towns wandering through the beauty and interest of our countryside and the Youth Hostels Association also. The environment of course embraces all things living on this earth. The Council for Nature is one of our most important members and indeed it has three members sitting on our Committee, and that federation brings together all

those who are particularly interested in birds, beasts fishes and botany. We include the National Trust, which preserves so much natural and man-made beauty for the benefit of this and future generations, and of course we also include the Society for the Protection of Ancient Buildings. The Council for the Protection of Rural England, of which until a short time ago I was Chairman, is a federation of societies which are concerned with the countryside from the point of human beings; and just as the Council for Nature looks at the countryside from the point of view of nature, so these two federations provide the Secretaries and the Chairman and Vice-Chairman.

Having explained the composition of CoEnCo, I should like to say just a word or two about its organisation. It is not a new Society nor has it any individuals as members. It is simply a standing committee of federation of the representatives of a number of voluntary bodies. It does not occupy itself with anything which falls exclusively within the purview of any of its constituent members unless it is asked to do so. It co-ordinates the views of its constituent members and in suitable cases speaks on their behalf.

Let me give you a particular example and one where we can point to some success. Not long ago a proposal was made by the lorry manufacturers that they should be allowed to put on the British roads longer and heavier lorries. That was naturally anathema to many, if not all our members. The Society for Clean Air objected to the fumes, the Noise Abatement Society to the noise, the Society for Protection of Ancient Buildings objected to the vibration which was certain to be most destructive of the ancient buildings with which they are concerned, the Council for the Protection of Rural England objected to the so-called road improvements which it was quite obvious would result if larger lorries and sometimes a whole train of them were allowed upon our roads. All these and other members regarded this proposal as most damaging to the environment as a whole and so the Committee for Environmental Conservation was able to speak out loud and clear. As you all know, to their great credit, the Secretary of State for the Environment and the Minister for Transport have acted as we wished. Of course we do not claim the credit that is due to those two Ministers, but we did put forward on behalf of the conservation movement as a whole, the argument against approval of these larger lorries and we organised public opinion in support of what is now their decision.

I know, Ladies and Gentlemen, that a federation of the representatives of a number of amenity societies is not likely to attract newspaper headlines, nor can we claim to be a very glamorous body. It was, however, devised as a practical way of bringing together the representatives of all those voluntary bodies which are concerned with the environment, enabling them to speak with one voice and providing a single body to which the Government or Local Authorities could go to express the opinion of the conservation movement as a whole; and as such I believe it is deserving of general support from all those concerned about our way of life.

Ladies and Gentlemen, I would like to give a few other examples of the kind of things with which we are greatly concerned—water. Water was the only subject where we could not find an existing voluntary body which covered the whole subject and that of course was because there are so many aspects of it. There is the question of pollution, there is the question of adequate supply, there is the use of water for recreation and for the improvement of the general appearance of the countryside. And so it was that whereas as I have said, in almost every other case, there is an existing voluntary body which covers the whole subject, in the case of water we had to set up a sub-committee of our own under the Chairmanship of a very well informed and forceful personality interested in all these matters, Mr. Francis Corbin; and I am glad to say that one of the Livery Companies has been one of our best and strongest supporters. The Fishmongers have provided us with some money and enable us to meet in their beautiful hall. The Salmon and Trout Association have helped us with money and some of their experts have sat upon our committee

We are especially concerned with the pollution of our rivers and I have already, on behalf of CoEnCo, raised three major debates in the House of Lords in the last 15 months. The first of these was calling for something to be done as a matter of urgency about the pollution of our rivers. The most striking fact is this. Two-thirds of the water supply of London, including all that we drink, comes from the river Thames, and the Thames since Mid-Victorian times has been kept reasonably clean and pure, pure enough for it to be, as I say, the main water supply of London. But if you go to the North of England you will find that in the industrial areas there, rivers which two or three hundred years ago were probably cleaner and purer than the Thames itself, have now, ever since Mid-Victorian times and ever since the industrial revolution, been so completely polluted that it has been impossible for them to be used as a source of water supply to the towns upon their banks. Well, I am glad to say that steps are being taken to deal with this matter. The late government undertook that something should be done, they inaugurated a survey of all the rivers of this country and the present government shows every sign of carrying it on.

The pollution in modern countries is quite appalling and we must beware not only that we do not follow their example but that inadvertently the same kind of thing does not happen here. Lake Erie between Canada and the United States of America is hopelessly polluted and I was very glad to read in the paper last week that an agreement has been reached between the United States and Canada for the expenditure of untold millions of pounds on purifying Lake Erie and the other Great Lakes. We must beware also of the pollution of the sea; not only the oil-pollution, of which we have read so much recently, but pollution by chemicals and by untreated sewage. It is an interesting fact that if one large oil tanker sank in the Baltic it would be enough to pollute the whole of that sea and it would be a matter of decades before the Baltic could be purified.

I was very glad to read of an international conference between governments which was held in London last week where Mr. Peter Walker in his opening address gave a bold and courageous lead to other countries and pointed out that it was hopeless for any one country to try to do anything effective about the ocean as it was essential that from the very beginning there should be complete and close international co-operation in the matter.

Finally, I would just like to say a word about derelict land about which the Committee for Environmental Conservation is greatly concerned. And here again I am glad to be able to make reference to something that has been done which is of great interest to the City of London. Most of the drinking water of London, the domestic water supply which does not come from the Thames, comes from the river Lee, but until a short time ago nothing had been done to prevent the quarrying of stone and the working of gravel and sand which left large and unsighly areas of land completely derelict. As a result of activities of conservationists, in which the Civic Trust played an honourable part, a Bill has been passed through Parliament, and as many of you know, the river Lee is now an area which is being reclaimed and where future generations will be able to find interest, pleasure and recreation.

Ladies and Gentlemen, the City of London has a great record in the matter of conservation, going back long before most of our voluntary bodies existed. Tomorrow there is a ceremony in Epping Forest, which I had been hoping to attend, where a field study centre is being opened. It was in Mid-Victorian times that the Corporation of the City of London promoted legislation in the House of Commons which has resulted in the preservation of Epping Forest under the aegis of the City of London, and it is London which has provided most of the money for the preservation of it; and I hope that in the case of this country park, as we now call it, on the Lee just north of London, the citizens and people of London will find a new area of recreation and beauty for their enjoyment added to that which has been saved by the City of London in the past.

Ladies and Gentlemen, we are now all becoming keenly alive to the need for the struggle against pollution. But this pollution has increased, and is constantly increasing, as a result of technical and industrial development. Fortunately there is at the same time an increasing awareness amongst the people of the country as a whole, that money is well spent in preserving and improving our environment and I am very glad to come here to address you friends and members of the Society for Clean Air who have done so much as a pioneering body in this matter.

Great things have already been achieved, the pea-soup fogs of London, which I remember in my youth, have really ceased to exist. You have still much more to do and I am confident that you will do it, and I hope you will bear in mind the Committee for Environmental Conservation which has just as much at heart as you have the purification of our atmosphere, and remember that there are other forms of environmental pollution which are an ever increasing problem. I hope that we shall go forward in alliance until the future of the environment in this country is preserved and improved for generations to come.

A New Air Pollution Film, "The Air—My Enemy"

16mm copies available from the Gas Council Film Library, Viscorn House, 6-7 Great Chapel Street, London, W1V 3AG.

Speaking at the preview showing of the new Gas Council film "The Air—My Enemy" Sir Henry Jones, Chairman of the Gas Council, said that "the film seeks to warn of the dangers from all forms of pollution—a subject in which the gas industry has been something of a crusader".

Miss Eartha Kitt introduced the film and used her vibrant voice to full effect in speaking of the fresh clean environment of her childhood in the Deep South, which she did not appreciate fully until she moved to New York. She said action was necessary now, otherwise future generations would regard not only the air but their ancestors as enemies.

The main theme of this excellent colour film is contamination of the air, but examples of water pollution are shown with telling effect. Widespread location filming shows the extensive damage we are inflicting on our environment and the costly search for remedies. Spokesmen from the North-East and Sheffield give contrasting comments on the situation in their own localities, while the success of London's elimination of smoke is dramatically shown.

But, the film asks, "What about sulphur dioxide?" 1200 measurements are taken throughout Britain every day, and we know that about six million tons of sulphur dioxide are pumped into the air every year. The film also poses such questions as "How do we balance the good with the bad?"—The unforeseen effects of DDT are shown, but it is also pointed out that DDT has helped control malaria. Tall chimneys have been erected to throw effluent above the temperature inversion level, but this could be just spreading pollution into the country-side and hill tops.

Instances of society tolerating self-inflicted damage are also shown—such as the fact that in America a woman has up to ten times as much DDT in her milk as the Government permits to a cow, or the fact that in Tokyo, if a policeman directs traffic for 20 minutes he must pump his lungs clean and wear a respirator.

The film, written and directed by Sarah Erulkar, indicts human greed as the root cause of all forms of pollution. Some of the poisons we can see, smell and even taste, but others are polluting the world almost unnoticed, and we are only aware of it when it is too late. Th film depicts the poisons "we ourselves have created" but poses the question—"can we now control them?"

Christine Smith

The Society's New President

Mr. Stanley E. Cohen, C.B.E., was installed as President of the Society at the Annual General Meeting held in Guildhall on Tuesday the 22nd June to succeed Sir Kenneth Hutchison, C.B.E., F.R.S., who had held this office for the past two years.

Mr. Cohen, who up to the time of his installation as President, had been Honorary Treasurer of the Society for 14 years, is a Common Councilman of the City of London. He has served in that capacity since 1951 and in 1965 held the office of Chief Commoner.

He has served as Chairman of various committees including that of the Public Health and Port Health Authority. It was in his capacity as Chairman of the City's Public Health Committee that on the 2nd October, 1955 he was responsible for making the whole City a smokeless zone. More lately he has originated the clause in the City's Various Powers Bill which, has just received the Royal Assent, enabling the City to limit the use of oil to that with a sulphur content of 1 per cent.

Mr. Cohen's other activities are many and varied. He has been a Governor of the Maudsley Hospital and the Royal Bethlem Hospital for 12 years; he is a Governor of Christ's Hospital and a Liveryman of the Worshipful Company of Stationers and Newspaper Makers, and is a Senior Past President of his trade Federation of which he is now an Honorary member. He is a member of the Clean Air Council of the Department of the Environment.

Mr. Cohen served throughout the 1914-18 War with the Honourable Artillery Company and was twice wounded in action. He is a Grand Officer of the Order of Merit of Chile and holds the Order of Homayoun of Iran. In 1966 he was made a Commander of the Order of the British Empire.

In earlier days Mr. Cohen achieved a double hat-trick at cricket; at golf he has twice holed in one. Continuing his athletic activities at a more advanced age, he first went skiing at the age of 60 and first swam at the age of 62.

WEATHER, INVERSIONS, AND AIR POLLUTION

Alice Garnett

Emeritus Professor, Department of Geography,
Sheffield University,
and Director, Air Pollution Research Unit

Over recent years much attention has been directed to the importance of spells of anticyclonic weather in providing conditions that give rise to inversion of temperature at or near ground level, and hence to risks of severe incidents of air pollution. Layers of very "stable" air (i.e. within which temperature no longer falls with increasing height, and indeed commonly increases to give ' inversion ' of the normal conditions) are often associated with marked spells of calm or of only very light winds. These stable layers inhibit the free vertical movement of air and diffusion of its pollutant matter, thus acting as a ceiling or lid beneath which the stagnant air collects or drifts lightly—spreading mainly laterally. The stability of the air and the low wind speeds are closely interrelated and become important parameters in air pollution study.

Not merely one, but a variety of synoptic situations and weather conditions must, however, be considered when reviewing the range of meteorological circumstances that restrict rather than enhance opportunities for natural free ventilation. Moreover, the conditions within about the first 1,000 ft. may present quite different problems from those within 1,000-2,000 ft. levels above ground, so that a "two-tier" climatological problem needs to be considered. Likewise the character of emissions and pollution problems differs fundamentally in these two tiers. The lower tier involves the effects of low chimney and stack effluent points (about 1-300 ft.), predominantly with limited buoyancy; the upper tier involves consideration of very high stacks (600-800 ft) with effective plume heights very much higher than this, reaching in many cases up to more than 1,500 ft. Generalisations related to each ' tier ' may not be applicable, as from one to the other in either the technological or climatological sense.

The importance of anticyclonic conditions in relation to the lower atmospheric levels and the complex of low chimney effluent levels is well familiar, and concerns primarily the relationship of the latter to the cooling of stable and comparatively calm air by radiation through a first atmospheric layer of about 700 ft. thickness (sometimes to much greater depth). Above this layer the air remains warmer, acting as an inversion lid—relatively shallow though the feature as a whole may be. In hilly terrain the condition is accentuated for valleys may fill with the colder denser air to some depth, but extensive if at times less deep radiation inversions also develop over open terrain and featureless relief. Seasonal differences in the duration and intensity of these characteristics can be pronounced. In the sub-Pennine country of the North Midlands, for example, it has been found that whereas from spring until late autumn at least for some hours during each day the radiation inversion is broken down and free ventilation temporarily established, during winter months there are many occasions when the noonday sun cannot break through to warm up the ground layers sufficiently. Inversions then persist continuously perhaps for some days, so long as the weather system lasts. Towns in such localities and types of terrain need to be watched, as an umbrella of highly polluted air may develop under the inversion ceiling, spreading over the urban area, while surrounding higher hills and summits are bathed in sunlight with clear skies.

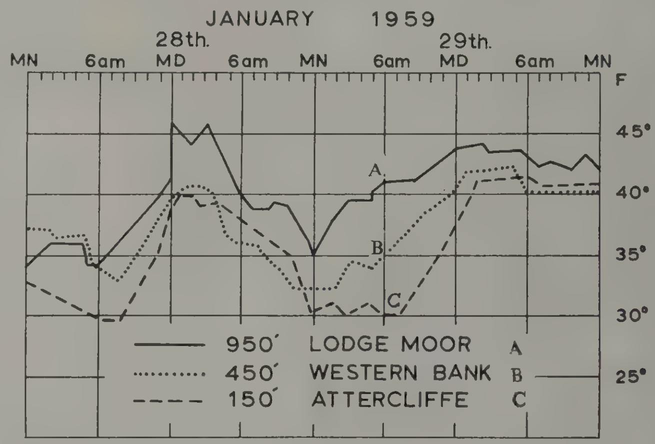


Fig. 1. *For three Sheffield sites temperature conditions associated with marked inversion of temperature. The location of the three sites A, B, and C is shown in Figs 2 and 3.*

Fig. 1 illustrates the continuity in severe conditions of winter inversion of temperature that can persist and characterise a hilly urban environment. Despite the moderating effects that the urban industrial heat island in the valley can induce, temperatures at 150 ft. were persistently lower than those at 950 ft.—at times by as much as 10°F. The continuity of SO_2 and smoke pollution that occurred under such conditions of prolonged winter anticyclonic weather are indicated in Figs. 2 and 3, when for spells of from three to four days' duration considerable areas (particularly in the valleys) were subjected to mean daily sampling values approaching or exceeding 1,000 $\mu g/m^3$. The completion, stage by stage, of a programme of smoke control for the whole of this city has eliminated the widespread adverse conditions that these figures illustrate for December 1959; but even now, with adverse weather conditions short spells of quite high pollution may develop locally within the city.

The occurrence of ground fog with such conditions is often noted, when base layers of the air have been cooled to temperatures below condensation ' dew point '. This can affect pollution in several ways. In some cases it may prolong the inversion of temperature if the sun cannot break through or dry up the fog. On the other hand, the presence and development of fog may cause more effective deep mixing of the ground layers, despite inversion conditions, so that pollution at low chimney heights and near ground levels is spread aloft through the fog zone with ground level concentrations thereby reduced. But, equally, pollutants from moderately high chimneys, emitted into the fog at a higher level, by the same process may be brought down near to ground in the course of the fog mixing process. The initial advantage of the moderately high stack (with plumes of limited bouyancy) can thus be lost. When, under favourable conditions, the sun breaks down the inversion for a few hours or longer, each noonday period, hourly pollution sampling generally shows a remarkably sharp diminution in ground concentrations during these hours. But a short phase of very high pollution may immediately precede this spell, consequent upon what is often described as "fumigation", i.e. when polluted air from aloft is brought down to ground level with convective overturning of the air before free ventilation has been fully established, during the final phases of inversion-breakdown. If "night storage" of pollution from industrial or other sources emitting into stable calm air has occurred, this must aggravate the severity of the morning fumigation. Effluent points that seem to cause no problems by day when free ventilation operates, may be assessed very differently under the stable air conditions at night.

Fig. 2. *Duration (in days) of areas affected by smoke pollution exceeding 1,000 μg/m³ as the daily mean during winter anticyclonic weather, and prior to the advent of smoke control (after December 1959). Note: A, B and C relate to the sites of temperature stations in Fig 1.*

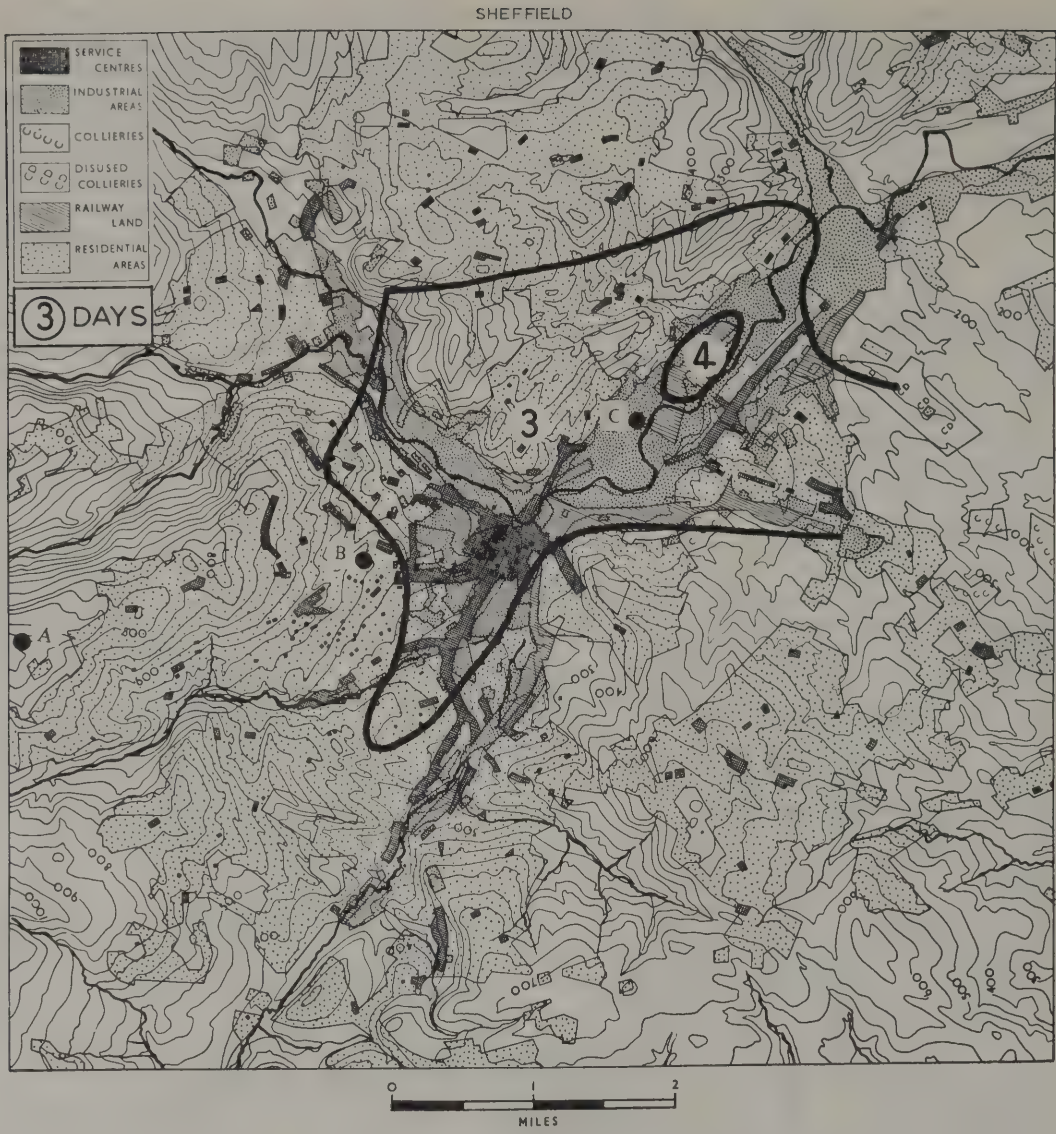


Fig. 3. *Areas affected by SO_2 pollution recorded for the same period and conditions as in Fig. 1.*

Fig. 4 illustrates the simultaneous occurrence of high pulses of smoke pollution occurring as 'fumigation' lasted for one or more hours during periods when the lapse rate of temperature, vertically, was breaking down from positive to negative values, as stable air was changing to neutral or unstable conditions. Important diurnal variations of this kind are entirely masked in the 'average' data that all too frequently are the only bases of assessments that are made with reference to air hygiene.

Layers of very stable air (with or without full inversion of temperature) do not, however, occur only at or near ground level. They are often numerous, and occur within a wide range of altitudes. This is a fact which at times seems to be overlooked in pollution assessments. Indeed, ground level radiation inversions of the type described above are frequently developed in association with—and because of—a much deeper condition of inversion in the free air above, in relation to which the whole pattern of anticyclonic weather has largely developed. The bases of such inversion may lie at no more than heights of 1,500′-2,000′, but they also occur at altitudes both much higher and lower than this. Plumes from very high stacks, with considerable effective plume height can bore their way through a shallow low level inversion near ground, and once through this barrier to vertical movement, a return of the effluent to ground levels is unlikely. Such plumes may well have lost effective buoyancy at a height of 1,500′ or more, but they may then be subject to the restrictions imposed by the high level inversion in the free air above. When weather changes bring about the final breakdown of the high inversion, pollutants trapped beneath this will likewise be subject to some degree of fumigation, which will often reach ground levels some distance from the source effluent points.

An example of the effects in hilly terrain of the coincident development of both ground level valley-inversion and 'free-air' higher levels of inversion is seen in Fig. 5 with respect to pollution hour by hour at three stations.

One (61) was located outside Sheffield in uninhabited moorland at 1,300′, well above the levels of low inversions that characterised the Sheffield valleys (59) at 450′ and (19) at 150′. The latter station shows the characteristic diurnal cycle in the industrial sector, with final fumigation during the morning hours of 6 October. The station at 450′ was less continuously affected by the low radiation ceiling, but experienced strong fumigation with the breakdown of both lower and upper inversion levels, later in the morning of 6 October than was the case at the lower station at 150′. At station (61) conspicuous fumigation only occurred during the final breakdown of the free-air inversion level, in response to wider synoptic changes during the afternoon hours.

It is important to remember that weather types other than anticyclonic may be of considerable significance, bringing, through air stabilisation and inversion unfavourable pollution conditions. Generally, these are of a more transitory character and last only for some hours rather than days, and are dependent on the interrelationship of air mass characteristics of which depressions, fronts, etc. may be composed. For example, the approach of a somewhat stagnant or slow moving "warm front" is associated some miles *ahead* of its passage, with a shallow cooler base layer of air with warmer air above this, thus bringing transitory inversion conditions and some stabilisation of ground layers. These conditions—when winds are light—may produce unpleasant high pulses of smoke and sulphur dioxide. Likewise, the approach of a stagnant cold front can be associated *behind* its passage with warmer (or less cold) air above colder ground air; but air motion may in this case be more turbulent, and pollution less pronounced.

Fig. 6 illustrates the sequence of high pollution pulses that were associated with the passage of a stagnant front that reached the north east approaches to Sheffield in the early afternoon of 12 December 1966. The high pollution that then occurred bears no relation to anticyclonic inversion conditions. The front brought very high pulses shortly after midday in the lower Don valley, and between 14 and 15 hours in the centre of the city, finally reaching the west and south-west outskirts at about 15 to 16 hours. The extent to which this diurnal pattern differs from that expressed by mean monthly evaluation of hourly changes is shown for the sampling stations 18 and 59. High pulses of SO_2 also occurred, lagging slightly behind those evident for smoke.

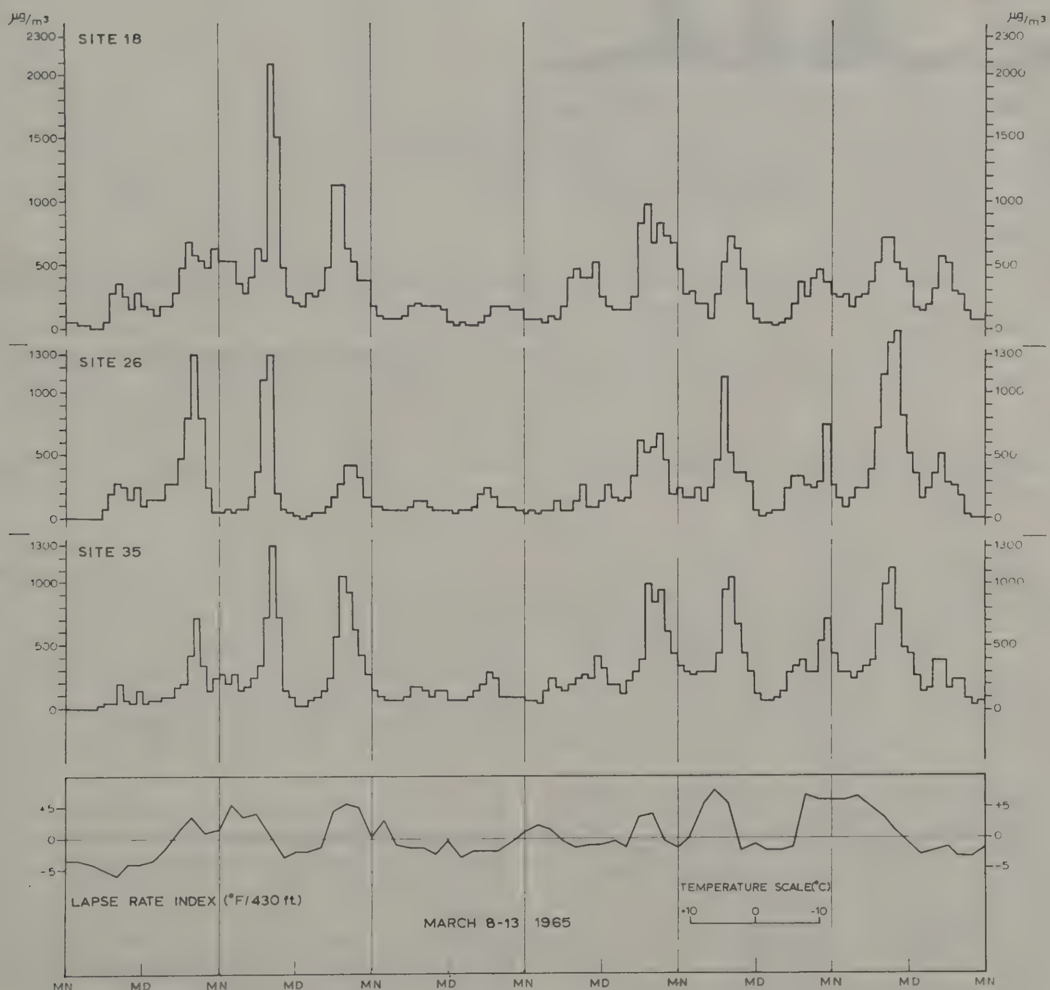


Fig. 4. *Hourly variations in smoke pollution recorded at sites in the upper, middle and lower Don valley. Pulses of high pollution are seen to coincide not only with each other but also with the breakdown of conditions of inversion of temperature—i.e. when the graph showing hourly variations in the lapse rate index reveals changes from positive to negative values.*

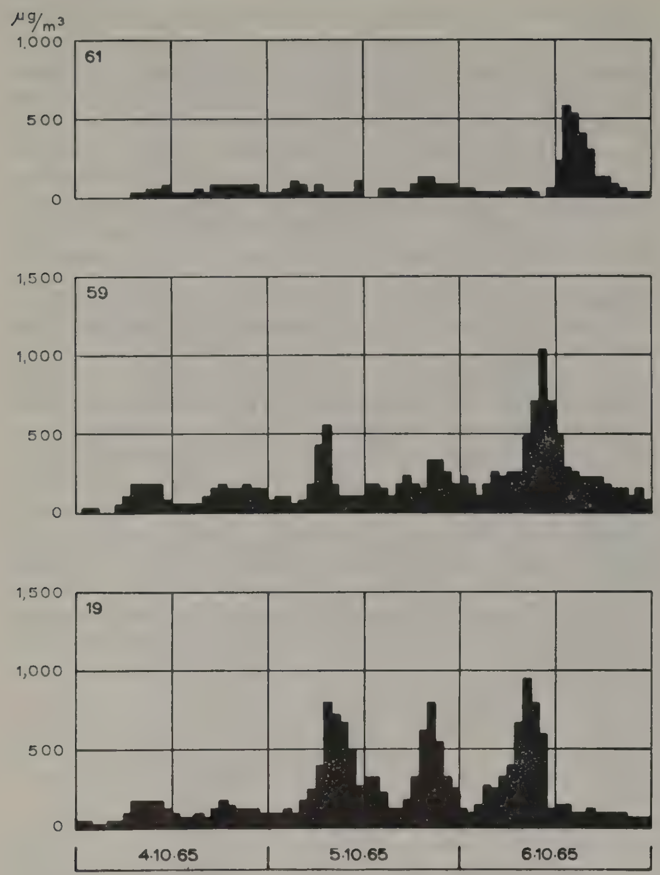


Fig. 5. *Hourly variations in smoke pollution 4-6 October 1965 at three stations. Sampling at the highest site (61 at 1,300 ft) showed only the effects of terminal fumigation with the final breakdown of an inversion aloft.*

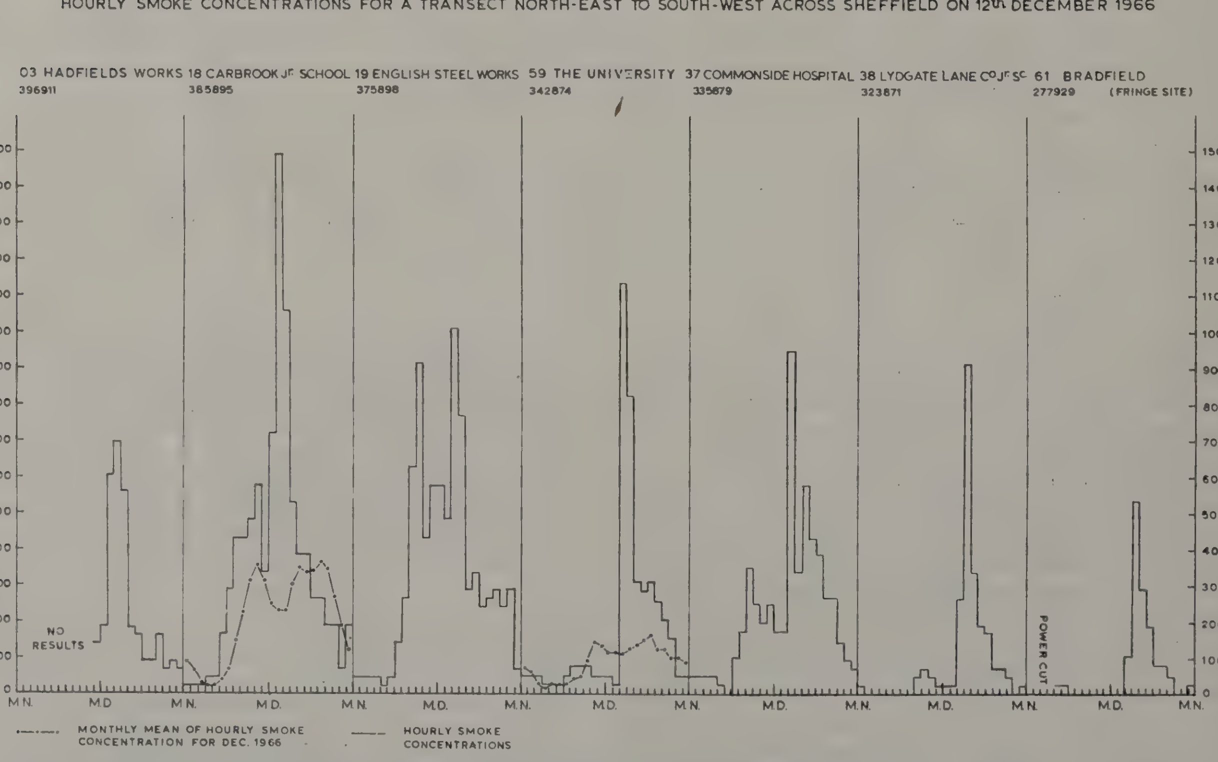


Fig. 6. *The progression of pulses of high pollution at 13-16 hours experienced across Sheffield during the passage of a slow moving front, on 12 December 1966. The differences in the mean monthly assessment of hourly variations as compared with those for one day is shown for stations 18 and 59.*

Apart from these more general meteorological considerations, some types of cloud formation produce inversion conditions in the free air—at the cloud base or as a continuous upper cloud cover. An important example of this is afforded by the low stratus (sheet or layer) cloud formation which seldom has a base higher than 1,500′ and more often very much lower than this—even at times down to no more than a few hundred feet above ground level. Above such cloud an inversion layer is characteristic stratus cloud is often formed when moist air blows across a land surface whose temperature is cooler than that at which condensation would occur in the warmer humid air passing over it. With a surface wind at about 5-10 knots and air that then becomes cooled below condensation point, *stratus* cloud forms at the top of the mixed layer, to extend through a zone that may have a thickness of about 500′-1,500′ above which inversion develops, checking further free vertical movement. Plumes from high stacks in the ' upper tier ' of our considerations could be much modified in such conditions (see Fig. 7) for they may be trapped under the *stratus* cloud-summit inversion, as at the same time the effluent is continuously injected into a very humid and often somewhat turbulent thickness beneath this level. Consideration as to the likely effects of the presence

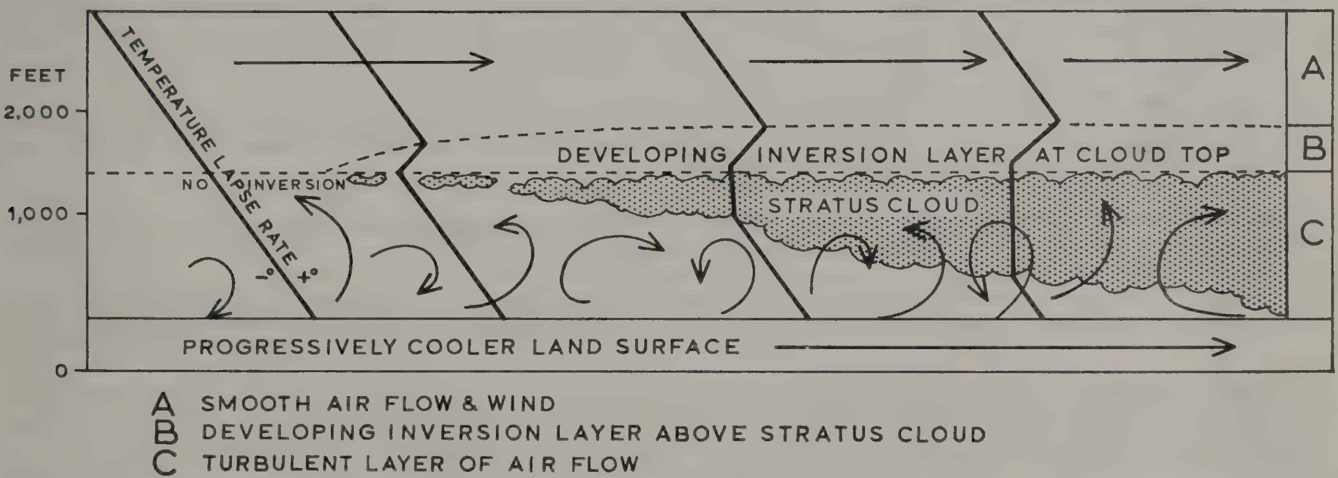


Fig. 7. *The formation of stratus clouds in relation to turbulent and smoother air flow and the development of high inversion levels within the first 2,000 ft. These conditions may frequently characterise some coastal climates.*

in these conditions of SO_2 in quantity, with oxidation to SO_3; the known hygroscopic qualities of the latter, and its change to H_2SO_4—give food for thought, particularly in relation to continuous high level emissions from power stations. Some regions are more likely than others to be affected by such meteorological conditions, but little thought as yet appears to have been given to regional implications arising from this, in the context of air pollution.

Very stable layers and inversions thus occur at a variety of levels in the lower atmosphere (0-2,000′) and with respect to a wide range of complex meteorological circumstances, and their effects on pollution concentrations at ground level may vary greatly. Sometimes they occur at low altitudes above normal turbulent and somewhat unstable surface conditions, in association with moderate winds at 10 knots. Case studies in Sheffield have shown that it is not uncommon under such conditions to experience, intermittently, very high pulses of sulphur dioxide, lasting for an hour or longer, while smoke pollution is at the same time negligible in amount. Yet when calmer anticyclonic conditions develop, associated with pronounced stability during ground level radiation inversions, the same sampling sites may show high concentration of both sulphur dioxide and smoke in a diurnal pollution pattern that is identical. It must not, however, be assumed generally, that smoke and sulphur dioxide invariably follow a similar diurnal pattern. Different weather can produce important contrasts, day by day.

The comparatively recent advent of the building of very high stacks (600′-800′) defines an admirable policy in terms of clean air control, but fuller examination of the ' climatological potential ' of the levels up to 2,000′ is greatly needed. Wind speeds (and directions) show different characteristics from those at the surface, yet pollution assessments must often be attempted only from surface meteorological data. More information is needed regarding the likely frequencies and duration of inversions at or just above stack and effective plume heights. Recent research work of the C.E.G.B. throws light on some of these problems. Of importance in this regard is evidence showing that high ground level concentrations from high stacks have come with high winds in summer—not during winter, as is the case with the "low-tier" pollution systems; likewise, that high ground level concentrations have been coincident with high winds, and when atmospheric stability and inversions have occurred *above* stack height. (See papers published in *Atmospheric Environment* Vol. I).

In Great Britain there is considerable local and regional climatological variety—despite our apparent small size. A case might well be made seeking as a matter of national importance, for a more complete examination and report on these variations than at present exists, to provide an evaluation of regional differences from the stand-point of clean air control, with respect to an upper (1,000′-2,000′) no less than a lower (0′-1,000′) system of climatological variables, and contrasting technological emission factors associated with these two atmospheric levels.

Grateful acknowledgement is extended to the Ministry of Technology (now Dept. of Trade and Industry), the Gas Council, and the Centre of Environmental Studies for generous financial support and loan of apparatus, without which the work of the unit could not have continued.

Pollution from Boiler Stacks and Engine Exhausts–the Chemistry of Air Pollution and its Solution by the Profit Factor

by

C. G. Henson

The combustion of fuel is intended to provide energy in the form of light, heat or power. In doing so, gaseous products are discharged into the atmosphere and it seems fair to say that in general, combustion efficiency or usable energy is inversely related to air pollution. In other words, the lower the efficiency of combustion, or energy production per pound of fuel, the higher the general air pollution.

However, one must ask oneself what is really meant by air pollution. The average person thinks purely in terms of black smoke and if this is cured by making it white, he is happy. He is happier still, if there is no smoke at all, and yet poisonous, unseen gases could still be discharged.

Black or brown smoke invariably means poor combustion (and certainly is air pollution) being basically composed of unburnt carbon. White smoke could still be poor combustion, with the carbon particles scrubbed, or filtered out, before being discharged to the atmosphere—but still with poisonous gases. No smoke at all can be good combustion, or bad combustion with an excess of air, but in either case unseen poisonous gases can still be discharged to the atmosphere.

Throughout the ages, man has always produced an antidote for anything he has done against nature and he is gradually now getting to grips with air pollution. At present, however, the control of exhaust gases is still in its technological infancy, in so far as it is generally practised.

General Pollutants—Gaseous products of combustion from boiler stacks or engine exhausts can lead to the following, or any composite mixture of the same, being discharged to atmosphere:

> Water – Carbon Dioxide – Carbon Monoxide – Smoke – Sulphur Oxides – Sulphuric Acid – Nitrogen Oxides – Unburnt Hydrocarbon – Acid Smut – Particulate Matter – Fly Ash—together with miscellaneous gases and oxides.

Of the above, water would seem to be the only totally acceptable emission to animal life with carbon dioxide acceptable to most forms of plant life. None of the other noxious products of combustion are digestible to any great extent by either animal or plant life and are certainly polluting the atmosphere in the huge quantities now being produced by man in his continuous search for "profits". When one speaks of air pollution therefore, one must think in wider chemical terminology than at present, where the major concentration by environment authorities appears to be solely one mission of Sulphur Dioxide (SO_2). The other noxious by-products result mainly from improper combustion of impurities in the fuels and residues of incombustibles. Even with good combustion they include some carbon and oxides of those metals which are present in varying amount as impurities in the fuel, such as lead, sodium, calcium, magnesium, potassium and vanadium. Their carbonates are the major components of fly ash and smoke.

When elemental sulphur is burnt, sulphur oxides are produced and the amount of free oxygen present during this process (i.e. excess air) determines the toxicity of the sulphur oxide discharged to atmosphere. Upon initial oxidation sulphur dioxide is produced and on further oxidation, sulphur trioxide. This, when combined with water, such as condensation of exhaust gases (or dew point) produces sulphuric acid which besides being extremely toxic and irritating to living matter, is also very corrosive to plant and equipment.

The problem of some metal oxides, such as vanadium pentoxide, in addition to their toxicity, is their basic effect of corrosion on boiler tubes. This oxide is molten at normal boiler combustion temperatures and deposits on the tubes. This, in turn, being fluid, attracts sulphates and fly-ash, thus gradually building up more and more deposits, until the passage of flue gases becomes impossible. A reduction in oxygen is necessary to inhibit vanadium pentoxide into lower oxides, such as V_2O_4 or V_2O_3 which have much higher melting temperatures.

Due to the use of lead as an "anti-knock" palliative in petrol engines, and the increasing number of cars on the road, it is not surprising that this metal is receiving great attention by all pollution conscious authorities. The form of lead used for the purpose is tetraethyl lead, and approximately 80% of this is emitted from engine exhausts as fine aerosol particles. Carbon monoxide is the other main pollutant from petrol engines.

Diesel engine exhausts emit similar noxious products as furnaces using light fuel oils, i.e. nitrogen oxides, sulphur oxides and various metal oxides dependant on the source of fuel oil. However, carbon particulate and heavy smoke are the visible pollutants and on which Authority is taking action by spot road tests.

In high-temperature combustion processes involving air as the oxygen supply, nitrogen and oxygen can combine to form a small amount of nitric oxide (NO). A secondary reaction of NO with oxygen at subsequent lower temperatures forms nitrogen dioxide (NO_2). In addition, a reaction of pairs of NO molecules can lead to nitrous oxide (N_2O) and oxygen.

The mechanism by which NO is formed from nitrogen and oxygen depends upon reactions of nitrogen atoms with oxygen molecules and oxygen atoms with nitrogen molecules, in the following manner:

$$N + O_2 \qquad NO + O$$
$$O + N_2 \qquad NO + N$$

Emmission levels of nitrogen oxides depend on (a) the fuel composition and combustion temperatures (b) the location and duty of the burner and its geometry (c) amount of air used in and during combustion (d) residence time in furnace (e) presence of fly ash.

Remedial Measures—As far as boilers are concerned, a much greater interest is now being taken in the training of combustion engineers, and this is going a long way to reducing the amount of carbonaceous emissions, by more efficient combustion. Carbon monoxide is also being reduced by keeping a careful watch on such things as flame temperature, air supply and flame propagation, but the other noxious agents still remain, i.e. sulphur, metal oxides, fly-ash and nitrogen compounds. These result from reactions in the flames, acting on either the sulphur and metals in the fuel or the nitrogen in the combustion air.

Similarly, with petrol and diesel engines, more and more large transport fleets are being better maintained. This is reducing the carbon particulate from diesels and carbon monoxide from petrol engines. There is still, however, the question of sulphur and lead emissions to be contended with.

It will be seen from the above that in combustion, the amount of excess air is very important. It must be kept to the lowest amount possible, consistent with a non-smoking stack or exhaust without carbon monoxide in order to reduce the harmful effects of vanadium, sulphur, carbon particulate and nitrogen. A 60% reduction in emission levels of nitrous oxides has been observed when excess air is decreased from 15% to 2 to 3%. This reduction of excess air also increases the combustion efficiency by raising the heat in the furnaces and reducing the temperature in the exhaust or stack. It has been reported that a gain of approximately 1% in efficiency is obtained by decreasing excess air from 20% to 5%. In so doing, one has to be careful not to reduce the stack temperature to a point where water condensing out of the stack gases forms sulphuric acid, i.e. the dew point. However, if one can inhibit the formation of SO_3 then sulphuric acid will not be obtained, metal sulphate will not be deposited, and excess air can be still further lowered.

One can see, however, even with a near stoichemetric balance, that poisons can still be emitted from some metal oxides in fly-ash. To get over this problem, some expensive equipments have been devised in the form of electrostatic precipitators, scrubbers and filters. Additives have also been put in fuel oils and petrols by suppliers to combat acidic ash composition, but in the main these additives are designed to stabilise the fuel, control utilisation rates and modify flame characteristics. Choice of additives already in commercial fuels depends on the source of fuel, the type of equipment in which it is to be used, the characteristics of the fuel and, on what is probably the most important, the economics of the specific situation, i.e. the suppliers' profit factor.

To produce commercial fuels which, on combustion, would not in some form, poison the atmosphere would be very expensive, and we are told it is not an economic or viable possibility. Recent reports show that there is a shortage of oil and that world prices are increasing rapidly. Fuel oils are now being sold with an increasing wax content, and it would seem, with greater impurities which are forcing up maintenance costs.

Governments have not yet got together to determine limiting factors for the various noxious pollutants, and let's face it—pollution is world-wide, it knows no barriers such as the borders of adjacent countries, or the seas around the the British Isles.

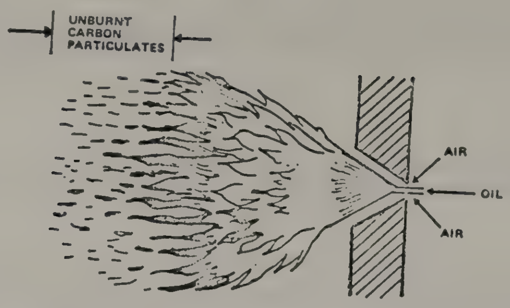
It is therefore left to the user to do something about his own air pollution, and it is now possible for the user to considerably reduce this, and at no cost to himself, providing he goes the right way about it.

First, the user can make sure that his engineers are proprely trained in combustion technology, and fully understand the operation of the plant under their charge, so that they are able to make proper adjustments to the air/fuel ratio, without having to rely on outside servicing. This alone will increase the user's profit factor by reducing his works costs as well as going a long way to reduce pollution.

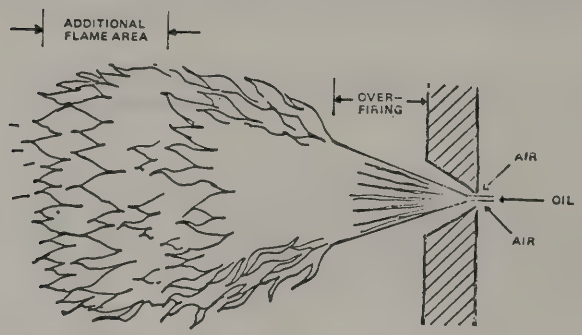
Secondly, he should make sure that the plant operator is able to operate the plant efficiently by giving him the necessary instrumentation, i.e. steam recorder, CO_2 and smoke indicators in the case of furnaces and the latest tuning equipment for engines. The operator's interest will be so increased in running the plant economically that greatly reduced running costs will more than recover this capital cost in a very short period. At the same time, proper plant maintenance must be carried out and in good time, before things go too far. The old maxim of a "stitch in time saves nine" applies equally well to plant maintenance.

Thirdly, he should not be misled into thinking that by burning a higher cost 35 sec. low sulphur oil for example, his maintenance and air pollution problems are solved. Lighter fuel oils can still have a vanadium and a high paraffin wax content. Again one has to go well below 0.5% sulphur oils, in order to make any appreciable effect on sulphur oxide emissions. With proper conditioning treatment, so-called heavy fuel oils can now be burnt by using advanced pyrochemicals, not only with just as efficient combustion control, actually leading to lower consumption, but with lower maintenance costs and much reduced air pollution. In other words, the user is able to increase his profit factor by still using a cheaper oil and actually save in fuel consumption.

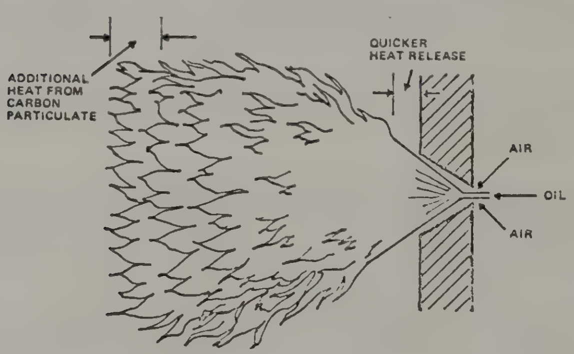
Illustration of manganese additive in combustion from observations and coloured photographs



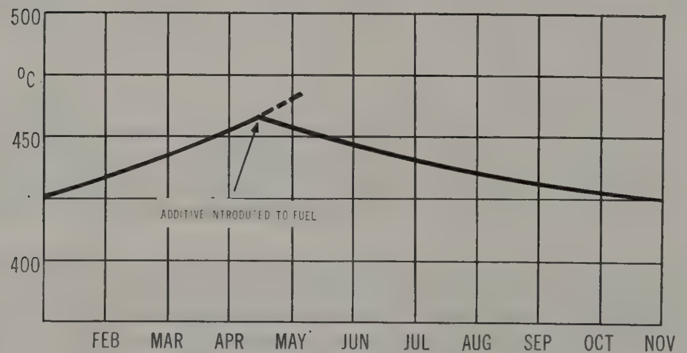
Flame configuration without treatment



Flame configuration with treatment but without alteration to oil or excess air



Flame configuration with treatment after reduction of oil flow and excess air



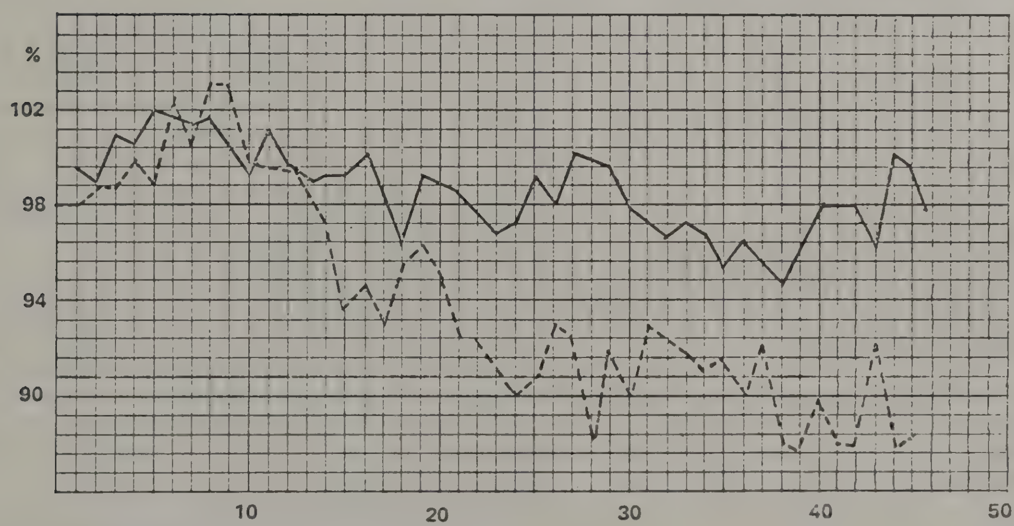
EFFECT ON FLUE GAS TEMPERATURE BY UNBLOCKING CONVECTOR BANK USING MANGANESE ADDITIVE DISCUSSED IN THE TEXT.

	O_2%	P.P.M. Before Treatment SO_2	P.P.M. Before Treatment SO_3	P.P.M. After Treatment SO_2	P.P.M. After Treatment SO_3	% Sulphur in Fuel Oil	Date
Boiler No. 1	2·6	1,222	37	—	—	2·41	1.4.70
Boiler No. 3	1·4	1,342	23·1	—	—	2·40	22.5.69
" "	2·3	1,200	22·8	—	—	2·30	22.5.69
" "	3·0	1,255	25·9	—	—	2·30	22.5.69
" "	2·0	—	—	1,020	Nil	2·31	27.8.69
" "	1·3	—	—	472	5·0	2·37	4.3.70
" "	1·6	—	—	1,062	Nil	2·27	1.4.70

O_2 measured in last boiler pass

SO_2 and SO_3 measured at air heater inlet

Results taken during years run of 115,000 lb/hr combustion engineering boiler showing reduction of sulphur oxides and lower oxygen requirement when using manganese additive referred to in text.



WEEKS

No. 1. Control Boiler .... without treatment

No. 3. Test Boiler .... with treatment of manganese additive referred to in text

Percentage change in evaporation rate (115,000 lb/hr boiler) representing approx. 4¾% saving in fuel costs

Fuel Additives—Having completed the arrangements outlined above the user should seek a good fuel-oil additive, but in so doing he should acquaint himself with the chemistry of reaction which additive suppliers claim for their product. At the same time the user should make sure that the product he proposes to use has been certified by at least one Public Health Authority as being safe to use. It is no earthly good using a compound which, in itself, is based on a metal which will produce corrosive slag or increase noxious oxides. Although there is as yet no law in this country prohibiting certain additive metals these are vetted by users and by certain States in America.

The following is a typical bid specification for a fuel oil additive in the States:

1. A fuel oil additive that increases combustion efficiency of No. 6 oil (3,500 sec. Redwood) from 4%to 10% without any adjustments in the burner or automatic boiler controls.
2. An additive that will make possible turn back of the oil flow from 4% to 10% to provide more heat and cleaner combustion on less fuel.
3. An additive which will reduce smoke of No. 6 oil as measured by a Bacharach Industry Equipment Corporation Tru-Spot Smoke Meter, from a six to a three reading while providing increased percent of CO_2 in the stack gases and while lowering the stack temperature.
Note—Bacharach No. 6 is equivalent to Ringleman No. 1.
4. An additive that needs no mechanical application, that dissolves sludge and disperses the heavier molecules uniformly throughout the fuel, either when it is added to a delivery load of oil or when it is dropped into the tank, just before filling with oil.
5. Additive must emulsify up to 2% of water in tank.
6. Additive must prevent carbonisation of burner, must prevent rust in fuel tank, fuel lines, etc., and on other valuable burner parts.
7. Additive must prevent the formation of sulphur and vanadium slag and remove it completely from fireside tubes and/or sections. It must reduce the sulphur in this slag as SO_4 by at least 60% and reduce the water soluble vanadium by 95%.
8. Additive must prevent the formation of acid smut emissions from the stack.
9. Additive must have a flash point (Cleveland Open Cup), in excess of 160F.
10. Additive must also dissolve all sludge and disperse it uniformly in lighter fuel oils. Additive must be capable of re-blending stratified fuel oils.
11. Additive must prevent the formatoin of SO_3 in the flame and at the same time reduce the vanadium pentoxide to a lower oxide.
12. Supplier must present data by a recognised testing laboratory supporting items 1—11 above.
13. Additive must *not* contain—

a. Copper	—Forms electrochemical corrosive slag.
b. Lead	—Highly toxic, forms electrochemical corrosive slag.
c. Iron	—Promotes SO_3 and sulphate slag.
d. Nickel	—Highly toxic.
e. Cobalt	—Promotes SO_3 and sulphate slag.
f. Chromium	—Highly toxic.
g. Alumina oxides	Errosive to burner tips and tubes, super heater, promotes SO_3 and sulphate slag.
h. Vanadium	—Highly corrosive slag (V_2O_5).
i. Sulphonates (organo-metallic sulphonates)	—Promotes SO_3 and sulphate slag.
j. Zinc and Tin	—Toxic combustion emissions.
k. All metal Carbonyls	—Highly toxic, exposure can produce pyrophoric effects.
l. Magnesium and Calcium	—Errosive catalyst produces friable ash which, when wet, can be corrosive and cause acid smut. Complication in use, and difficult to keep in suspension.
m. Chlorine	—Corrosive, promotes toxic emissions.
n. Sodium	—Corrosive.
o. Aromatic solvent, naphtha, and kerosene	—Relatively ineffective.
p. Phosphate	—Produces metal phosphate slag.
q. Silicon	—Errosive, ineffective against vanadium and sulphur.
r. Cadmium	—Highly toxic, produces heavy metal slag.
s. Bismuth	—Ineffective.
t. Barium	—Highly toxic.

14. Supplier must furnish Certificate of Insurance for product liability.

In considering the price of an additive one should consider the dosage rate, on what this dosage rate is based, and its percentage cost to fuel consumption costs. Some additives for example, give no saving on fuel consumption. Others claim a small saving by cleaning fire boxes and tubes etc. while others claim similar results by the removal of sludge in the tank. Some additives are cheap and some are expensive. Some fulfil claims under certain conditions, but not under others. Some suppliers offer a technical service, others have sales interest only. It is, therefore, very difficult to make the correct choice, but it is suggested that perhaps the above specification could be used as a basis on which to judge the various claims made for additives.

Fundamentally a good additive is one that contains a workable and proven amine, is safe to use and has no health hazard. These types of additives are initially expensive and have their chemical formulae patented. These patents also give fundamental data to substantiate the claims for its use thus giving confidence to the user.

Manganese has long been known as a combustion improver and it will not have escaped the reader's notice that it is not listed above as a non-desirable metal. A number of manganese additives are now on the market but not all are combined with amines that work. One manganous-amine complex which is producing remarkable results, utilises an amine having a nitrogen content of a specific minimum amount, which, being combined with a very low ppm of a special form of manganese makes it non-hazardous to health. The additive dosage rate for large users is very economical, being 1-24,000. Even for small users, it is still economical, being 1-4,000.

This manganese-nitrogenous complex is first and foremost an oil conditioner and secondly, an exceptionally good combustion improver. By conditioning the oil the sludge in the tank is emulsified and burnt, with up to 2% of moisture inherent in the oil.

Improvement in combustion by using this type of complex is found in two ways. First, by reducing the size of atomised fuel droplets—thus making more use of the oxygen in the ignition period giving a much quicker heat release and second, by having the property of burning up more of the otherwise lost hydrocarbons at the tail end of the flames.

This particular type of manganous-nitrogenous complex also stops tank rusting and is able to provide a reducing atmosphere in the furnace. By giving greater control of the oxygen for combustion the complex becomes extremely useful to oil-fired steel forging and copper smelting industries.

It will be recalled that the amount of excess air should be the minimum possible, and as this particular complex is able to burn more fuel per unit of time, a reduction in fuel consumption becomes possible with a reduction of secondary air. It has been found that the saving in fuel consumption at least pays for the price of the product and in many cases shows a considerable *nett* saving on fuel costs alone. For example the 'on-cost' would be in the region of 2% with gross savings approx. 4% and upwards, i.e. a nett gain of 2%.

As to air pollution, the patent specification for this complex gives examples of boilers and engines which show considerable reductions in emission of SO_2, carbon particulate, carbon monoxide, nitrogen oxides with complex elimination of sulphur trioxide and vanadium pentoxide. Many installations in the United Kingdom as well as in the United States are also giving similar results.

General—It must be appreciated that a complete ban on metal pollutants, besides being unenforceable from economic considerations, is also undesirable as, without some of them in trace amounts, no plant or animal life, as we know them at the present stage of evolution, could survive.

No fewer than fifty-one metals from aluminium to zirconium are, according to good authority, known to be found in the human body in varying amounts. Iron, magnesium, manganese, molybdenum, calcium, colbalt, copper and zinc are known to be essential, in *trace form*, to human life, while vanadium, nickel and tin are thought to be.

Metals serve as catalysts and are often incorporated in proteins to assist or initiate controlled biological reactions. For example, we are told that there are four atoms in haemoglobin molecule and each of these attract an oxygen molecule, which is then carried through the body in the red blood pigment. Again, in plants we are told, an atom of magnesium is the centre of every molecule of chlorophyll.

While we should not therefore become too alarmist about certain metals we, in this country, certainly should be taking some action on others, particularly the heavier metals that apparently perform no known useful biological function. These are the metals which are toxic in their elemental form, especially if absorbed as small particles. They are even more hazardous in organic compounds, as they are more readily absorbed into the body and become concentrated in the nerve tissue. Methyl mercury for example, is far more dangerous than mercury in its metallic form. Tetraethyl lead is another and one which is readily soluble in fats.

Many are the stories on lead poisoning, particularly of children. Everybody has some lead in their body and some are able to cope with more than others. Most of us get lead from the ingestion of lead particles in food and water as well as through the inhalation of petrol engine exhausts. People living or working most hours in cities, show a higher lead content that those living or working in the countryside.

It is true that most people, even in large cities, encounter much less poisonous contaminants than workers in the metal producing industries, but many of us are breathing this in for 24 hours, not just the 7 to 8 hours on which industrial standards are based. There are, it is reported, no "lead free" people. Even newborn babies have lead in their blood. Lead concentrations are spreading even into the Arctic and Antarctic due to man's massive use of lead, nearly $1\frac{1}{4}$ million tons per year in the United States alone. Scientists have found that the lead content of Arctic snow and ice quadrupled between 1750 and 1940, then nearly tripled again up to the middle of 1960. The first increase is said to be due to the great expansion of lead smelting in the industrial revolution and the second, the use of lead in petrol.

Although people apparently still take in more lead with their food (approx. 300 microgrames per day) than by breathing, only about a tenth of this is absorbed and retained in the tissues, whereas a third of inhaled lead is retained. There is already a tremendous effort being made in the United States and in other countries, to do away with lead in petrol. It has been reported that this is now the No. 1 source of lead in the air—more than 400 million pounds per year. In view of this therefore, anyone contemplating the use of an additive in boilers or furnaces of any type should certainly look into its chemical formation.

	Control	Test
Unburnt Hydrocarbons	102	56
SO_3	15.4	1.4
Nitrogen Oxides	1,340	1,120
CO_2	6.8	7.3

Result of test on 15 hp diesel engine showing reduction in air pollution using manganese additive referred to in text using fuel containing 0.18% sulphur

	Control	Test
Per Cent Carbon Monoxide:-		
Idle	6	Nil
2,000 rpm	7	Nil
15 mph	3	2
30 "	3	0.5
40 "	2	0.5
50 "	2.5	1.0
60 "	2	0.5
Ringleman Smoke Units:-		
Idle	2	Nil
2,000 rpm	6.5	Nil
15 mph	3	1
30 "	2	1
40 "	2	1
50 "	2	1
60 "	2	1

Result of test on late model petrol vehicle having 15,000 miles on clock using standard leaded petrol for high compression engine. Test result taken after using manganese additive referred to in text for 350 miles. Also checked at 1,000 miles. Compression figures after test showed 7% improvement. Due to better valve and ring sealing.

In conclusion, the Department of Environment in the United Kingdom should now set up much more testing equipment than hitherto. The concentration so far on sulphur dioxide is not enough. Taller chimneys also are not enough. They will undoubtedly stave off the evil day when ground concentration in the United Kingdom becomes too much, but they are only a palliative, not a cure! and one cannot reduce ground concentration of sulphur oxides and carbon particulate from diesels or carbon monoxide and lead from petrol engines by higher and higher engine exhaust pipes.

Every user of fuel should investigate what he himself can do to alleviate the pollution problem, if not from a sense of responsibility, surely from his own profit point of view.

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"Air Knows No Frontiers"

INTERNATIONAL NEWS

U.S.A.

Environmental Protection Agency's Interim Report on Lead Study

Lead levels in the air have increased significantly over the past seven years at several individual locations in Cincinnati, Los Angeles and Philadelphia, according to a preliminary summary of test data released by the Environmental Protection Agency.

Among a total of 19 sampling locations in these three cities at which ambient lead levels were measured in 1961-62 and again in 1968-69, that later levels were higher at all but two sites. In Cincinnati, increases ranged from 13 to 33 per cent; in Los Angeles from 33 to 64 per cent; and in Philadelphia from 2 to 36 per cent. The report points out that the levels are related to the individual site, and cannot be combined to characterise the entire city nor to compare one city with another.

The report also contains ambient air levels for Los Alamos, New Mexico, for the period 1968-69. Los Alamos was not studied in the earlier years.

Blood lead levels also were measured in a total of 872 women living near certain sampling sites in residential areas of these four communities to provide base data for use in future studies to determine whether changes occur. Women were chosen because they were most likely to have spent a substantial portion of each day in the area around the sampling sites. Their blood levels ranged from 15·4 micrograms of lead per 100 grams of blood in Los Alamos, to a level of 20·6 in Philadelphia.

It has not yet been determined whether there is a true relationship between the ambient air lead levels and the blood lead levels measured in the four communities. Environmental Protection Agency officials stressed that further statistical analysis of the data is needed before firm conclusions can be drawn.

United States Exhaust Laws Viewed with Dismay

British motor-car manufacturers have met the final United States federal regulations for the control of exhaust emissions with some dismay. A spokesman for the Ford Motor Company said: "We might just manage those governing hydrocarbons and carbon monoxide, but those for oxides of nitrogen look near impossible."

Unless the regulations are relaxed, or there is a considerable technical breakthrough, European manufacturers may be unable to export cars to the U.S.A. in five years' time.

British Leyland would be particularly hard hit, as the United States is its most important foreign market for high performance cars. The loss of this market could mean a number of sports models being discontinued because it would not be profitable to make them for the home market alone.

Mr. William Ruckelshaus, Administrator to the Environmental Protection Agency, admits that the standards are stringent and agrees that the cost to both the motor industry and the consumer will be substantial; and although the achievement of these standards poses major engineering problems and will be costly and may, in the case of oxide of nitrogen emission, require a technological breakthrough, he feels that the need to protect the nation's health demands that effective control of motor exhaust emissions be placed high on the list of national environmental requirements.

The problem that faces American car manufacturers is magnified in Europe. Much of the equipment at present available for reducing toxic emissions, can cause a substantial loss of power which, while it might be acceptable in cars with large American engines, would be far less so in European cars of between one and two litres. In present European models, there is also very little room for bulky equipment.

SWEDEN

Environmental protection is a topic of general concern in Sweden today. Sweden has a population of about 8 million, distributed over an area comparable to that of France, with 85,000 lakes and forests covering some 55 per cent of the country and one might ask how a country like this could really have pollution problems.

One of the most characteristic developments in modern Sweden has been the increasing concentration of population in large towns. It has been found that pollution created in towns contaminates far beyond the boundaries of the cities. It should, however, be added that, compared with those of other countries, the environmental problems of the Swedish urban communities are very small.

Air pollution is confined to principal towns and areas adjacent to certain industrial complexes. In the towns a great deal of air pollution is caused by motor vehicle exhaust gases. Owing to the cold climate large quantities of energy mostly produced by burning oil, are used to heat houses and other buildings. Motor exhaust fumes combine with boiler smoke to form local concentrations of sulphur dioxide which, although below the levels attained in larger cities in other countries, still exceeds the normal sanitary limit. Air pollution can also be aggravated in winter by the creation of temperature or inversion layers, which impede natural dispersal in the atmosphere.

There is a growing awareness in Sweden that it is of little use being a leader in the fight against pollution unless other nations follow, for winds bring sulphur dioxide and other pollutants which contaminate Sweden's clean air.

In 1969, concern for the environment found expression in the Environmental Protection Act, probably the most all embracing legislation of its kind in the world. Among other things, it laid down that anyone planning or carrying out work which might damage the environment had to apply for a licence to continue. Applications have to be made to the National Franchise Board for the Environment, an administrative court. The Protection Board was placed at the centre of a whole network of controls, with general power to conduct research and give advice. The Board is advised by three bodies; the National Conservation Council, the Water Conservancy Council and the Air Quality Board.

Some of the things that indicate Sweden's concern with environmental pollution are; jet aircraft have been prohibited at Bromma, the smaller Stockholm airport with connections to other parts of the country. Since January 1st, 1970, the maximum permitted amount of lead in petrol has been 0·70 grammes per litre, and the aim is to lower this gradually. The maximum sulphur content of fuel oil has been limited to 2·5 per cent, by weight, and 1 per cent in Stockholm and Gothenburg. Limits have been fixed for pollutants from cars: from this year, the maximum permitted carbon monoxide is 45 grammes per kilometre, and 2·2 grammes per kilometre of hydrocarbons—these regulations are expected to reduce the discharge of pollutants by 40 per cent.

All of Sweden's universities now offer courses on environmental planning and pollution control. The courses consist of 10 weeks of study covering such widely varied topics as ecology, human genetics and air and water pollution. The courses are open not only to students, but several persons in local administration, industry, education and public health take part in the courses.

International Air Pollution Control and Noise Abatement Exhibition, 1-7 September 1971—Sweden.
Mr G. E. Speight, a member of the Society's Executive Committee will be presenting a paper on "Air Pollution Problems in the British Iron and Steel Industry".

SOUTH AFRICA

A leading newspaper in Johannesburg has launched a campaign to bring to the notice of the public the pollution problems in South Africa. The campaign deals not only with the most obvious aspects of pollution, but also with problems caused by indifference to the needs for conservation and poor town planning.

In Johnnesburg just breathing the air can be the equivalent of inhaling 15 cigarettes a day and on this city 22 tons of solids in the form of soot, dust and other materials rain down every month on each square mile.

The newspaper says that Johannesburg's Traffic Department periodically announces an impending purge on diesel vehicles 40 per cent of which emit excessive fumes—but the Municipality's own buses are among the worst offenders.

The newspaper hopes to keep the public informed of its investigations and findings through this campaign.

Anti-Smoke Plan
A programme aimed at bringing Johannesburg under total domestic smoke control within six years is to be submitted to the city council. To complete the programme, the council will have to create a new smoke control zone at least every three months. So far two zones have been declared and a third order has been submitted to the Minister of Health.

Johannesburg has been divided into 22 zones. A standardised zone order to be submitted for promulgation excludes industrial premises on industrial stands, where the less stringent Smoke Control Regulations will apply.

COUNCIL OF EUROPE

A medium term plan for air pollution control has been drawn up by Council of Europe experts. This scheme will be submitted shortly to the Committee of Ministers. The experts have chosen the following nine priority points to be included in the first two-year programme for 1972-73.

1. Exchange of information on national regulations and practices in air pollution control.
2. Study of the methodologies used, including the use of air quality criteria and standards in air pollution control.
3. Study of early warning systems.
4. Comparative study of measures for reducing emissions in certain typical cases of industrial polluting installations including licensing systems and concrete licensing conditions, and costs chargeable to companies.
5. Reduction of pollution caused by motor vehicles, boats and aircraft (including problems raised by metallic and other additives to motor fuels).
6. Reduction of pollution caused by space heating.
7. Study of small-capacity refuse incinerators. The big incinerators should be regarded as industrial installations.
8. Information and education of the public in the field of air pollution and its control.
9. Review of progress on questions dealt with in resolutions adopted since 1968 by the Committee of Ministers of the Council of Europe (i.e. the Declaration of principles on air pollution control; air pollution in frontier areas; limitation of pollutants emitted in the atmosphere by motor vehicles; co-ordination of efforts made in town and country planning and in air pollution control; control of sulphur dioxide emissions into the air).

The scheme, adopted by the Council's Committee of Experts on Air Pollution, takes account of the priorities established by the European Conservation Conference held in Strasbourg in February 1970, Nature Conservation Year.

This plan for air pollution control forms part of the Council of Europe's permanent overall campaign for the protection of the environment. The campaign covers three main sectors: conservation of the quality of the environment; rational use and management of land in accordance with sound ecological principles; education and information of the public.

BRAZIL

A system of levying fines on industries held responsible for pollution has been introduced in Brazil by the State Government of Guanabara. Confined to Rio de Janeiro and its environs, the anti-pollution drive is being co-ordinated by the UNDP—assisted Guanabara Institute of Sanitary Engineering. During one six-month period last year, the Institute's laboratory staff analysed more than 50,000 air and water samples. In the course of determining water pollution by industrial wastes, 300 sites were inspected in the area. As a result of the investigations fines were levied on a total of 471 firms and warnings were issued to another 400.

NETHERLANDS

The densely populated and highly industrialized area between the harbours of Rotterdam and the North Sea is the region known as the Rijnmond, where close to a million people live and work. Situated along natural and artificial waterways and near the greatest port in the world, the Rijnmond has attracted a large number of oil refineries, petrochemical and chemical plants which constantly fill the atmosphere with various quantities and types of pollutants.

One of the methods employed to counteract air pollution here is constant measurement of sulphur dioxide content in the atmosphere, which may be taken as the norm for the total pollution level. If this shows that a fixed threshold value is being exceeded, and if rapid clearing of the pollution by the winds is not imminent, a warning is sent out to industry through a semaphone network. A large number of restrictions will then be voluntarily imposed by industry on itself, aimed at drastic reduction of the pollutants discharged.

The 31 detector masts which are located in the Rijnmond region test the air for SO_2 64 times each hour and report their findings electronically via telephone lines to a computer at the warning centre at Schiedam. By comparing the average values with calculated values from the same measuring points at the same time on a previous day, a figure is obtained that indicates the trend of the alteration in the SO_2 content at each individual measuring point.

Since 1948, a committee has been active in Rotterdam, checking soil, water and air pollution. This is an official body, maintaining close contact with the Rijnmond authorities and the Netherlands labour inspectorate. The Rotterdam committee believe that much of the success achieved by the air pollution measuring network in the Rijnmond region is due to the close co-operation between the industries concerned and the Rijnmond authorities, even though this co-operation is still voluntary.

Recently, the amount of sulphur compounds in the atmosphere above the region has gone down significantly, and the quantities of nitrogen oxides have been maintained at a constant level.

In spite of doubled production in the industrial area, the amount of soot and sulphur dioxide in the atmosphere has also been reduced, partly owing to the changeover from heavy fuel oil to natural gas and low-sulphur fuel oil.

BOOK REVIEWS

Teaching for Survival
Mark Terry. Ballantine Books in association with Pan. Price 40.

A handbook for environmental education written by a young American teacher who maintains that there should be a complete revolution in modern education. He says that from the very beginning children are led to believe that the materials of the classroom, from paper to pencils, are there to be used in as large a quantity as possible without any thought of the cost to the environment as a whole. He points out that no child ever considers that the paper it writes upon and often throws away, came from a tree that took hundreds of years to grow.

From this fundamental, the author builds up a case that all teachers must rethink their whole attitude towards their subject and involve the pupils in a wider understanding of the environment. In this way, the school itself can become a model environment and serve as a central instrument for making society adopt a new and positive approach towards the reintegration of natural beauty as a meaningful part of Man's existence.

The author insists that one of the teacher's first responsibilities is the conservation of their material; "Teachers must learn to conserve and re-use materials they now treat as expendable, no matter how they may complain about shortages".

The author also stresses the vital importance of communication and thinks that the school environment must be presented more humbly to its students. He says that information comes into much better focus through group comparison and inclusion, rather than the rigid teacher-pupil relationship. He believes that schools should carry out complete surveys within their own district, evaluating its environmental policies and putting forward plans of their own to alleviate pollution, overcrowding, housing problems etc.

In the last section of the book the author gives examples of how he feels particular subjects have a definite relationship with the environment.

Suzanne Martin

Reader Enquiry Service No. **7194**

United States Environmental Protection Agency. Four new bibliographies with abstracts of air pollution aspects of emission sources, May 1971

These four bibliographies deal with nitric acid manufacturing; cement manufacturing; sulphuric acid manufacturing and municipal incineration. Each subject has been divided into fourteen categories and the compilation is intended to be representative of available literature, and no claim is made to all inclusiveness.

Reader Enquiry Service No. **7195**

Journal of the District Heating Association. First Quarter, 1971

This is the first of a new series of publications for the District Heating Association. In this issue there is a report of a speech by Paul Channon M.P., Parliamentary Under Secretary of State for the Department of the Environment, in which he says that there is no Governmental or mandatory obstacle to the establishment of district heating anywhere in the United Kingdom.

There is also a report of a District Heating Association meeting at which a speaker for the Welsh Office outlined the official routine and procedure for setting up a local authority district heating scheme. The Borough Architect and Engineer for Hammersmith describes the planning of the district heating scheme that has now been selected for the White City area.

Details are given on the International Convention on district heating to be held in Budapest in May 1973. Details are also given of the research now being undertaken at Government instigation to determine the ultimate economy of District Heating. A list of reference publications is quoted together with a message from Sir Donald Gibson, the President, on the need for more propaganda for district heating and total energy.

Reader Enquiry Service No. **7196**

The Electrical Association for Women—46th Annual Report and Report of the Caroline Haslett Memorial Trust

Establishing and maintaining communications are the essentials for success and contributed in large measure to the achievements during 1970 of the Electrical Association for Women.

There has been particular liveliness in the Association throughout the year, examples of this being the formation of Young Electrics Branches in the South of England and the starting of the Electrical Association for Women's activities in Northern Ireland.

Among the Association's many activities during the year have been participation in many exhibitions of varying character, but again emphasis has been placed on those with an educational flavour.

The Caroline Haslett Memorial Trust is a charitable body whose aims are to provide scholarships and other educational opportunities for women who are seeking or already pursuing careers in the electrical industry or in other fields requiring qualifications in science, mathematics, engineering, home economics and allied subjects. The Trust is administered by the Electrical Association for Women.

Reader Enquiry Service No. **7197**

Healthy Cities—A Study of Urban Hygiene
Brian Read. Published by Blackie. Price 75p net.

This is the first in a series of books aimed at bringing history up to date. Meant for children, this book has many charming illustrations and photographs of the past and present and some of the men who pioneered the way for combating pollution. There is an excellent Time Chart showing what happened through the ages from 5000 BC to 1969. There are chapters on the Art of Living in Towns; The Progress of Pipes; Nature Mending Nature; Water for Towns; The Search for Healthy Water; From Lead to Plastics; Town Cleansing; Town Rats; ' Fuliginous and Filthy Vapour '; The Manace of Science.

This is a very readable little book and should be read by all ages.

Suzanne Martin

Reader Enquiry Service No. **7198**

Atmospheric Pollution and Melanic Moths in Manchester and its Environs
R. R. Askew, L. M. Cook and J. A. Bishop. Blackwell Scientific Publications.

This booklet sums up the results of four years' research on moths which have been carried out in the Manchester area at sites in localities with moderate to extreme atmospheric pollution. It was found that the majority of species collected were dark in colour, many typically pale species being represented by dark variants. Four species polymorphic for melanic and non-melanic morphs have been examined in detail.

Reader Enquiry Service No. **7199**

Proceedings of Symposium on Multiple-Source Urban Diffusion Models. U.S.
Environmental Protection Agency. Air Pollution Control Office, Research Triangle Park, N.C. 1970.

This volume contains all the papers and discussions of the symposium. Mr. John T. Middleton, who is Acting Commissioner of the Air Pollution Control Office, states that "as we proceed with the implementation of the Clean Air Act, the meteorologist will be called upon more often to provide a mathematical description of the transport of air pollution. . . . The diffusion models are the yardsticks for furnishing quantitative determinations of ambient air concentrations of pollutants. . . . They should also be flexible enough to assimilate feedback from source emissions for obtaining solutions to both chronic and acute pollution problems. Future diffusion models that incorporate air pollution climatology are expected to be used more frequently in long-range air-resource-management programmes for the evaluation of future air quality and source locations with regard to projected emissions rates and population distributions. In order to interpret the relationship between proposed and existing source emission standards and ambient air quality standards, we need a quantitative account of the meteorological processes that cause pollutants to be diluted, chemically changed, or dispersed between source and receptor. Our hope is that by applying diffusion models to calculate the integrated effects of multiple sources of the same pollutant, we will be able to interpret the relationships between proposed or existing source emission standards and ambient air quality standards. Diffusion models can play a vital role in our attempt to systematically apply air pollution control theory on a regional basis."

Reader Enquiry Service No. **71100**

Environmental Lead and Public Health
R. E. Engel, D. I. Hammer, R. J. M. Horton, N. M. Lane and L. A. Plumlee. U.S. Environmental Protection Agency, Air Pollution Control Office, Research Triangle Park, N.C. March 1971.

This publication is a summary of the major public health problems associated with lead. It is divided into Lead Metabolism and Toxicology in Man; Lead in Diet and Consumer Goods; Lead in Air; Lead in Occupational Exposures and Lead Poisoning in Children. For each problem, the report succinctly discusses the scope and nature of the problem; the present scientific and technological knowledge relevant to its solution; the significant gaps in this state of knowledge; the predictions on the growth of the problem; and, in some cases, alternative approaches to its solution. 79 references are given.

Reader Enquiry Service No. **71101**

First One-Sheet Summary of a British Standard Published

The first of a completely new kind of publication, called "summary sheets" is available from the British Standards Institution, entitled BS3763Z Summary sheet extracted from BS3763: 1970 The International system of units (SI).

Summary sheets consist of both sides of a single A4 size sheet, on which is presented the salient points of a British Standard. Their production is a response to demands from industry, expressed mainly through the Standards Associates Section of BSI, that the "guts" of standards should be available in a cheap and concise form, so that the information contained can readily be made available to many people, for example a company's employees, where it would not be practicable to provide the whole standard. Clearly, there are limitations to this form of publication and they will only be produced where they provide useful information without countering the sense or intention of the original standard.

Summary sheet BS3763Z sets out the names and symbols for the base units, the supplementary units, the prefixes and all the examples of derived units given in BS3763, which is the main British Standard providing information on the International System of Units. It also gives rules for the use of the prefixes and lists those units outside SI which are nevertheless recognized by the CIPM (The International Committee for Weights and Measures), to be of such practical importance that they must be retained for general use with the system.

This new type of publication is still experimental and comments from industry are welcome—they should be addressed to the editor of BSI News at BSI, 2 Park Street, London, W1A 2BS.

Reader Enquiry Service No. **71102**

Clay Flue Linings and Flue Terminals

A new revision of BS1181: 1971, Clay flue linings and flue terminals, has been prepared by BSI to take account of legal and technical developments since the previous issue was published in 1961. These developments have led to the need for a comprehensive range of clay flue linings, flue bends and flue terminals suitable in dimensions and performance to meet the demands imposed when modern efficient heat-producing appliances are installed.

The specification deals with the materials, workmanship, design, construction, dimensional and test requirements for linings and bends which may be either square

in plan with rebated ends or circular in plan with rebated or spigot and socket ends and also with terminals which may be either square on plan tapering to a circular top or circular on plan, tapering or constant in plan. It includes a clause dealing with the designation of linings, bends and terminals for ordering purposes.

BS1181 also includes performance requirements for crushing strength, barrel permeability, heat resistance and acid resistance. Appendices provide descriptions of apparatus and techniques indicating how these requirements can be measured.

The specification finally deals with the requirements relating to the selection of samples for testing and also with the marking of articles manufactured and supplied in accordance with the specification.

Manufacturers of clay flue linings and terminals may apply to BSI for a licence to use the Kitemark under a certification and approval scheme based on this Standard.

Reader Enquiry Service No. **71103**

New additions to the National Society for Clean Air Library, available on loan

Coalite and Chemical Products Limited. Report and Accounts 1970/71.

Brian Read. Healthy Cities: a Study of Urban Hygiene. Blackie, 1970.

Mark Terry. Teaching for Survival: a Handbook for Environmental Education. Ballantyne, New York, 1971.

Seved Apelqvist. Pollution of the Environment and its Consequences. 2nd edition, Folksam, Stockholm, 1970.

Kenneth Mellanby. The Threat of World Pollution. The Essex Hall Lecture for 1971.

North of Scotland Hydro-Electric Board. Report and Accounts 1970/71.

R. R. Askew, L. M. Cook and J. A. Bishop. Atmospheric Pollution and Melanic Moths in Manchester and its Environs. Reprint from Journal of Ecology 8 247-256, April, 1971.

J. Pearson and P. B. Simpson. Total Energy in the Gas Industry. 108th Annual General Meeting of the Institution of Gas Engineers Solihull, May, 1971.

***United States Department of Health, Education and Welfare, National Air Pollution Control Administration.** Profile Study of Air Pollution Control Activities in Foreign Countries. First Year Report. November 1970.

United States Environmental Protection Agency. Air Pollution Aspects of Emission Sources: Municipal Incineration; Cement Manufacturing; Nitric Acid Manufacturing; Sulphuric Acid Manufacturing. Bibliographies with abstracts, May 1971.

Association of Public Health Inspectors. Conference Proceedings and Exhibition, Blackpool, 1970.

United States Environmental Protection Agency. Proceedings of Symposium on Multiple-Source Urban Diffusion Models, 1970.

Institute of Contemporary Art. Ecology in Theory and Practice 1970-71.

British Standards Institution. British Standard 3142 Part 3: 1970 Manufactured Solid Smokeless Fuels for Household Use Part 3: Specially Reactive Fuels for all Types of Domestic Open Fire.

Commonwealth Scientific and Industrial Research Organisation, Australia. Mineral Chemistry Research Report 1969-70.

Incineration Company. The Incineration of Industrial Wastes 17th Annual Refresher Course Current Practice in Fuel Efficiency, Southampton University, 1970.

The Bristol and West Building Society have launched a quarterly magazine called "Outlook" which concentrates on aspects of housing and conservation, written by experts in these fields. Each issue also contains a section called "What's What in Conservation" which lists amenity organisations operating at national, regional and local level.

* *Reference only*

"Living in Towns"—One Day Conference of the Association of Public Health Inspectors, Olympia, 25 June, 1971.

The Conference was opened by Mr. Birtwisle, the President of the Association of Public Health Inspectors, and four papers were presented on the theme 'Living in Towns'. Mr. M. Jacob, Chief Public Health Inspector of the London Borough of Islington, introduced his paper on "Answering the Housing Need". He was followed by Mr R. J. Stephenson, Assistant Scientific Adviser, Greater London Council, who spoke on "The Noise Problem". The President of the International Union of Air Pollution Prevention Associations Mr. H. Stephany, and the Secretary, Mr. J. Kramer, presented a paper on "The Control of Industrial Pollution". Mr. T. H. Iddison, Chief Public Health Inspector, London Borough of Dartford, then introduced his paper on "Clean Air". Mr. Millward, a lecturer in environmental health at Salford University, opened the discussion.

The discussion was mainly a chance to question the authors and for the delegates of Public Health Inspectors and Councillors to show how work was progressing, or not progressing, in their area. It was rather ironical that when speakers were talking on the subject of noise, most of what they said was drowned by the noise of passing trains.

A full report of the Conference will be printed in the August 1971 issue of "Environmental Health" obtainable from the Secretary, The Association of Public Health Inspectors, 19 Grosvenor Place, London S.W.1, price 20p.

Christine Smith

National Society for Clean Air

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Sir Kenneth Hutchison, C.B.E., F.R.S.

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Deputy Chairmen:
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SOUTH WALES and MONMOUTHSHIRE
L. Morgan, 9 Lodge Drive, Baglan, Port Talbot (5231)

The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant, and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

National Society For Clean Air

NEWS FROM THE DIVISIONS

EAST MIDLANDS

The Annual General Meeting of the East Midlands Division was held on 8 July in the Town Hall, Chesterfield.

His Worship the Mayor of Chesterfield, Alderman B. C. Willett, welcomed the 63 members present, and spoke of the excellent work of the Society and of the interest and support his Authority had tried to give to the reduction of atmospheric pollution, which was possibly the most important public health problem still to be resolved. The Mayor referred to the recent shortages in solid smokeless fuel, but now that the shortages were over he hoped that the Society and Local Authorities would have the satisfaction of seeing an acceleration of their programmes to banish the evils of smoke pollution.

The Honorary Secretary's Report and Financial Statement were read.

This was followed by the appointment of officers, Councillor C. E. Holland was elected Chairman, Mr. H. B. Dunstan, Deputy Chairman, Mr E. Raven, Honorary Secretary, Mr H. N. Eardley, Honorary Auditor, and Mr. V. Wales and Mr. W. R. Brownhill were appointed Scrutineers.

The election of the Divisional Council for the year 1971-1972 followed this.

The Chairman then introduced the Director of the Society, Rear Admiral P. G. Sharp, C.B., D.S.C., who gave an interesting talk on the impression obtained when he visited the International Clean Air Congress in Washington D.C. in December 1970. That this Congress was attended by almost 2,500 delegates from 37 nations and that 256 papers were presented and discussed, gave ample proof of the world-wide interest now being taken in the problems created by atmospheric pollution. It was gratifying to learn from the speaker, after acknowledging the spectacular advances made by other nations in other scientific spheres, that this country has probably made the most progress in combating air pollution, and that others are anxious to learn the practical ways in which this has been achieved.

The Chairman then introduced Mr. Stanley Cayton, the recently appointed Chairman of the National Society for Clean Air, and welcomed him to the Division so early in his year of Office. Mr. Cayton in reply spoke of his hopes for the future of the Society, and the increasing role he considered the Divisions should take in furthering its work in a changing world. He stated that apart from air pollution resulting from the combustion of fuels there were other forms of pollution from industry namely, dust emissions from the grinding, fettling and buffing of metals, difficult problems in themselves which also required attention. Mr Cayton also referred to pollution from smells, which could well come within the purview of the Society, but it was essential that expertise should be acquired by administering authorities in these special fields.

The retiring Honorary Secretary, Mr. G. Drabble, expressed his personal thanks to the Chairman, the Members of the Divisional Council and local secretaries of the places visited, for all their help during the four years of his secretaryship, and the Chesterfield Corporation and the staff in the Health Department for the facilities made available to him and the help given during this period.

The Chairman expressed the thanks of the meeting to the Chesterfield Corporation for the excellent arrangements made for the Meeting and for the hospitality provided.

E. Raven
Hon. Secretary

NORTH EAST

The Annual General Meeting of the North East Division was held on 30 April last in the Gosforth Race Course Banqueting Suite, Gosforth Park, Newcastle upon Tyne. Delegates assembled in the Banqueting Suite for morning coffee and were invited to inspect an exhibition, the main theme of which was "Electricity and Clean Air". Fortified by these refreshments, delegates were summoned to the business meeting.

During the course of this meeting the Chairman, Alderman B. N. Young, O.B.E., delivered his usual annual address which had been printed and previously circulated. In this address the Chairman expressed gratification on the dramatic change during the past 12 months in the smoke control outlook. On the occasion of the previous Annual Meeting, Smoke Control Orders were being suspended almost every week, all of which orders were about to be reimposed because of the substantial increase in the availability of open fire solid smokeless fuels. He expressed the view that the unhappy events of the past year or two surely were a conclusive indication, if indeed, any further evidence were needed, of the need for a realistic national fuel policy and he hoped that having got back on to a more or less even keel, steps would be taken to see that the chaos of 12 months ago did not happen again and that a national fuel policy would be forthcoming to ensure a long-term and relatively stable programme of fuel production and distribution. The Chairman continued by making brief references to the future of the Society and, in particular,

to the reconstruction of the Executive Council and its Committees. Local government reorganisation would, he declared, have a profound effect on local authority representation within the Society and he also referred to the changes in the allocation of duties relating to clean air as indicated in the recent White Paper. He concluded his abbreviated address by forecasting that a year hence members would be congratulating themselves upon the increasing momentum of the smoke control progress in the North East, provided that positive and practical encouragement was forthcoming from the Central Government.

The Chairman's address was followed by the election of officers which resulted in the re-election of the Chairman, Alderman B. N. Young, O.B.E., the Vice-Chairman, Councillor T. P. S. Prudham of Felling U.D.C. and Professor P. C. G. Isaac of the University of Newcastle upon Tyne and the Honorary Secretary and Treasurer, Mr. L. Mair. Mr. C. J. Davies of the City and County of Newcastle upon Tyne was re-elected Honorary Auditor for the ensuing year.

Following the election of officers, the Chairman made reference to the appointment of a Divisional Council which would greatly facilitate the examination of matters referred to the Division from Headquarters. The Honorary Secretary referred to provisions in the Bye-laws which allowed for the election, from the members of the Division, of a Divisional Council and how the constitution and the activities of that Divisional Council would be subject to the approval of the Executive Council. There was unanimous agreement that the Chairman, together with the Vice-Chairman and Secretary, be authorised to prepare a draft constitution and general outline of the proposed Divisional Council and report back to a subsequent meeting.

At the conclusion of the business meeting Mr. T. Rutherford, B.Sc., C.Eng., F.I.E.E., the Commercial Manager of the North Eastern Electricity Board gave an illustrated address on the development and use of domestic electrical appliances with special reference to the single white meter on a two tariff basis. During the course of his talk he referred to air conditioning, the electricity catering centre, the industrial applications of electricity and the operation of advisory bureaux. This talk was followed by a film on house improvement which showed examples of electrical adaptations in house improvement in various parts of the country. Mr. Rutherford concluded by showing a short film giving a brief preview of the Wallsend Testing Station which was to be visited later in the day by delegates.

Immediately after the talk and film show members were invited to pre-lunch cocktails followed by lunch at the kind invitation of the North Eastern Electricity Board which was attended by the Chairman of the Board, Mr. A. Norris. Mr. Norris expressed a warm welcome on behalf of the Board and referred to the common interest of the Board and the Society in the clean air problems of the region. The Chairman of the North East Division suitably replied and called upon Alderman J. T. Etherington, Gateshead C.B., to propose a vote of thanks to the North Eastern Electricity Board, to its Chairman, to Mr. Rutherford and to all those who had assisted in making such excellent arrangements for the meeting. This vote was carried with universal acclamation, after which delegates were conveyed by coach to the Wallsend Testing Station of the North Eastern Electricity Board.

On arrival at the Station delegates were divided into parties and conducted on an informative tour. It was explained that the functions of the Station were mainly in the field of precision industrial operations and scientific research, although there was also an administration section which including a training unit. Delegates were shown the operations and techniques employed in the testing of electricity meters, the reconditioning and testing of single phase meters and time switches and it was explained how the most up-to-date ultrasonic cleaning methods were employed to avoid repetitive handling. Perhaps the greatest interest was shown in the heating and air conditioning system which was the principal factor in the integrated design method of building. The aim was to maintain an optimum internal environment, irrespective of external climate, by minimising heat loss and heat gain. By such control it was found that the cost of the engineering services needed to ensure a satisfactory internal climate could be kept at an acceptable level. Delegates were informed that the capital cost of integrated design building was only 4 per cent higher than the traditionally designed building, whereas the advantages and economics of a stable internal climate more than compensated for this higher expenditure.

At the conclusion of the tour tea was served to members in the recreation club attached to the Station, after which delegates dispersed after an extremely interesting and informative day.

L. Mair
Hon. Secretary

YORKSHIRE

The Yorkshire Divisional Council visited the N.C.B. Roomheat Plant at Armthorpe, near Doncaster, on 15 June at the invitation of the Coal Products Division of the National Coal Board. Mr. A. E. Bloomfield, Marketing Manager, C.P.D. Midlands, welcomed members of the Society's Yorkshire Branch and introduced N.C.B. officials concerned with the production and marketing of Roomheat.

Mr. Bloomfield referred to the steady production of the fuel this year, the added availability from the second stream which was now being commissioned, and the promotional campaign which the N.C.B. were undertaking in connection with solid smokeless fuels. Roomheat would be the subject of special publicity and stocks already at some 16,000 tons would support the future production programme and ensure adequate availability over the coming winter months. Assurances were given that the total demand for solid smokeless fuel could be met as a result of the overall increased production planned this year by all producers.

Mr. J. A. Lloyd, General Manager of Coal Products Midlands Briquetting Group, explained the Roomheat process.

Basically there are six stages in the production of Roomheat briquettes which can be summarised as crushing the coal, drying, partial carbonisation, pressing the briquettes, cooling and finally quenching the product.

Although all of these operations are common place in industry individually, the degree to which they are carried out and the final product is unique.

Coal in the form of singles and smalls which has been washed to an ash content of less than 5 per cent is crushed initially so that about 90 per cent is less than

a quarter inch. The crushed coal is fed at a controlled rate into a vertical tube up which is passing at a high velocity, exhaust gases from a refractory lined furnace. The temperature of the gases varies from 400 to 450 C at the beginning of the drying and raises the bulk coal temperature to about 80 C. Due to the high turbulence in the drying tube the mass transfer is such that the coal emerges at about 4 per cent total moisture and is separated from the gas phase by two stages of cyclones.

The dried coal is then further crushed to eliminate any pieces which have slipped past the primary crusher, in doing so the size range is reduced to predominantly less than $\frac{1}{8}$ inch. This pulverised material is then bunkered and fed via a double screw conveyor into the carboniser.

The carboniser is the heart of the process in that it is here that roughly a third of the volatile 'smokey' constituents are dried off and burned in a separate furnace. This is achieved by fluidising the finely crushed coal using air which passes through small nozzles in the base of the carboniser vessel. The temperature is maintained in the range 415 to 425 C and is controlled by the rate of air admission, banks of thermo couples providing the necessary information for automatic control. The average residence time of the particles of coal is kept between 15 and 30 minutes but there is always an optimum residence time which requires a balance between smoke removal and briquettability.

The char, which has been produced in the carboniser, while still hot is then gravity fed to two roll presses which compact the char into briquettes and produce the distinctive shape of Roomheat fuel. The load on the press rolls is in the region of 250-300 tons and this ensures, when the carboniser conditions are correct, that the briquettes formed are of good shape and strength.

Because the briquettes as formed are hot they cannot be immediately quenched as this would cause degradation and loss of strength. Consequently they are cooled over a period of about one hour and then quenched in water at 50 C. The product is then tested immediately for resistance to impact and if satisfactory other criteria must be satisfied such as moisture, smoke index etc. before the briquettes are screened and accepted as marketable products.

Roomheat was required to conform to B.S. 3142 Part III and details of quality control to meet this specification were explained by Mr. Duncan, Chief Scientist, Coal Products Briquetting Group.

A tour of the Plant followed and members were able to discuss at length with official guides the many features of the process.

Prior to closure of the visit a general question and answer session took place.

Roomheat is a quality fuel for use on open fires and a wide range of closed appliances. Although high in price, consumer acceptance is already being established in Yorkshire.

At the close of the meeting the Chairman of the Yorkshire Divisional Council, Mr. J. W. Batey, expressed the sincere thanks of the Divisional Council to the Coal Board for their kind invitation to visit the plant. Members were much impressed by the technical achievements of this plant and were delighted to learn from the Coal Board representatives that the shortages of solid smokeless fuel which had so seriously affected the Smoke Control programme in the past year now appear likely to be overcome.

J. H. Wyatt
Hon. Secretary

SOUTH WEST

The Annual General Meeting of the South West Division was held on 17 June 1971 at the South West Gas Board's offices at Radiant House, Bristol. The Annual General Meeting, normally held in March, had to be postponed because of the postal strike.

Alderman C. Hebblethwaite, C.B.E., Chairman of the Health Committee, Bristol, was re-elected Chairman for the year 1971/72. Mr. G. J. Creech, who has been Divisional Secretary since the formation of the South West Division, retired from his post as Chief Public Health Inspector, Bristol, on 30 June 1971. The thanks of members of the National Society are due to Mr. Creech for the very able manner in which he has steered the Division through quite difficult times. The Division wishes Mr. Creech a long and happy retirement. Mr. D. J. Barnett, a Specialist Inspector with the Health Department, Bristol, was elected to serve as Honorary Secretary.

During the meeting of the Divisional Council further discussion was held on the question of the inadequacy of the control of chimney heights under Section 6 of the Clean Air Act, 1968. A report was also given on the supply of solid smokeless fuels. A representative of the Solid Smokeless Fuels Federation reported that the fuel position in the South West is much improved, and that there will be substantial increases in production brought about by the expansion of existing plants and the construction of new plants. As the effects of these increases in production will not be felt immediately, home production will again be supplemented during the coming winter by the importation of briquetted fuel from France. Members of the Divisional Council were entertained to lunch by the South West Gas Board.

In the afternoon, after a short business meeting during which the Annual Reports of the Honorary Secretary and Treasurer were presented, Mr. A. Olphin, the Publicity and Public Relations Officer (Conversion) of the South West Gas Board presented a paper on Natural Gas and the Conversion Programme. Mr. Olphin informed members of the conversion programme for the South West which should be completed by 1975, and outlined the history of natural gas in this country and the drilling techniques used in the North Sea. Mr. Olphin described the national grid distribution network and discussed the characteristics of natural gas and the necessity for different types of burners. The details of the conversion procedure adopted by the South West Gas Board were then explained, and Mr. Olphin finally dealt with members' questions. This talk was followed by a showing of the film on environmental pollution entitled "The air, my enemy", which is available on loan from the Gas Council.

At the end of this successful meeting members were entertained to light refreshments by the South West Gas Board.

D. J. Barnett
Hon. Secretary

Road Vehicle Exhaust Emission Testing

During the last two weeks of July the Society carried out a series of tests to measure the percentage of carbon monoxide in the exhaust gases of cars travelling along the seafront in Brighton. This was undertaken with the co-operation of Brighton Public Health Department and the Sussex Constabulary.

A total of 373 cars were tested and only 86 of these showed a reading of 4·5 per cent or under. 84 of the cars tested were over 10 per cent.

The instrument used was the Sieger Exhaust Gas Analyser, kindly loaned to the Society by J. & S. Sieger, of Poole, Dorset.

Legislation in W. Germany, France and Sweden restricts the emission of carbon monoxide from exhaust gases to 4·5 per cent while the engine is idling.

A full report and tables of results will be published in the Winter edition of *Clean Air.*

Erratum

Clean Air Year Book 1971-1972. Page 52.

The Diana Wyllie Film-strips are not available for loan from the Society but may be purchased either direct from Diana Wyllie or from the Society.

SMOKE CONTROL AREAS

Progress Report

Position at 30 June 1971

(Figures supplied by the Department of the Environment)

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smokeless Zones (Local Acts in operation)	44			—			—			—		
Acres, 3,400												
Premises, 41,060												
Smoke Control Orders Confirmed prior to 1/4/71	3,408			8			148			33		
Acres		959,693			1,097			77,488			8,594	
Premises			4,765,933			4,979			357,181			15,698
Smoke Control Orders Confirmed (1/4/71-30/6/71)	53			—			3			3		
Acres		20,149						2,540				
Premises			76,145						3,198		505	2,192
Submitted (1/4/71-30/6/71) ..	59			—			8			—		
Acres		25,067						8,644				
Premises			107,808						20,182			
Grand Totals	**3,564**	**1,004,909**	**4,949,886**	**8**	**1,097**	**4,979**	**159**	**88,672**	**380,561**	**36**	**9,099**	**17,890**

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30 June 1971

(Figures supplied by the Department of the Environment)

(1) Region	(2) *No. of black area acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	41,635	33·2	171,977	31·1
Yorkshire & Humberside	197,126	52·3	668,004	57·2
East Midlands	69,531	25·9	205,088	40·1
Greater London	249,372	76·2	2,183,156	82·7
North Western	202,343	50·4	842,164	49·5
West Midlands	86,318	34·7	399,836	38·0
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	853,830	48·1	4,498,922	57·9
Outside black areas ..	~~7,499~~ 151,079		~~17,077~~ 450,964	
Grand Totals	~~861,329~~ 1,004,909		~~4,515,999~~ 4,949,886	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Summer 1971)** *which gave the position up to* **31 March, 1971.** *They now show changes and additions up to* **30 June, 1971.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact. Orders that were due to come into operation but have been suspended are not included, as far as they are known.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Teesside
Teesside C.B. (No. 5).

Yorkshire

West Riding (North)
Halifax C.B. (No. 17). Aireborough U.D. (No. 26). Brighouse B. (Nos. 15 and 16).

West Riding (South)
Danton U.D. (No. 13).

North Western

South Lancashire and North-east Cheshire
Bury C.B. (No. 8). Leigh B. (No. 11). Ashton-under-Lyne B. (No. 10).

Central Lancashire
Preston C.B. (No. 22). Nelson B. (No. 5).

Midlands

Derby, Nottingham and Chesterfield
Chesterfield R.D. (No. 12).

West Midlands
Birmingham C.B. (No. 148).

London

Greater London Boroughs
Richmond L.B. (Twickenham No. 11).

Local Authorities Outside the Black Areas

Luton C.B. (No. 8). Oxford C.B. (No. 10). Staines U.D. (No. 11). Whiston R.D. (Rainhill No. 1). King's Lynn B. (Reffley). Lincoln C.B. (No. 3).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Tyneside and Wearside
Gosforth U.D. (No. 1).

Yorkshire

West Riding (North)
Brighouse B. (Norwood Green No. 20). Leeds C.B. (Nos. 90, 91 and 92). Elland U.D. (South Ward, 1970). Spenborough B. (No. 12). Morley B. (No. 42). Horsforth U.D. No. 31). Halifax C.B. (No. 17a). Heckmondwike U.D. (No. 8).

West Riding (South)
Sheffield C.B. (No. 27).

North Western

South Lancashire and North-East Cheshire
Radcliffe B. (No. 6). Stalybridge B. (Castle Hall No. 3). Droylsden U.D. (No. 14). Ashton-under-Lyne B. (No. 13). Eccles B. (No. 13). Royton U.D. (No. 7). Horwich U.D. (No. 3). Leigh B. (No. 12). Prestwich B. (No. 11). Worsley U.D. (No. 9).

Central Lancashire
Preston C.B. (No. 23). Rawtenstall B. (No. 3). Great Harwood U.D. (No. 3). Barrowford U.D. (No. 4).

Midlands

Derby, Nottingham and Chesterfield
Sutton-in-Ashfield U.D. (No. 1/1970). Beeston and Stapleford U.D. (No. 12). Carlton U.D. (No. 8). Ilkeston B. (No. 5). Derby C.B. (No. 21).

West Midlands
Sutton Coldfield B. (No. 19). Solihull C.B. (No. 17).

London

Greater London Boroughs
Lambeth L.B. (No. 25). Ealing L.B. (Nos. 52, 53 and 54). Greenwich L.B. (Abbey Wood No. 4; Nathan Way 1970; Royal Arsenal Western Enclave; Riverside 1970; Plumstead No. 2, 1970; Page Estate 1970). Croydon L.B. (No. 13). Kensington and Chelsea R.L.B. (North and South Stanley 1970).

Local Authorities Outside the Black Areas

Potters Bar U.D. (No. 4). Easington R.D. (Peterlee No. 1). Meriden R.D. (No. 5). Runcorn R.D. (No 5). Skipton U.D. (No. 7). Leamington Spa B. (No. 10). Reading C.B. (No. 15).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Tyneside and Wearside
Jarrow B. (No. 5), Newcastle-upon-Tyne C.B. (No. 14). South Shields C.B. (No. 7).

Teesside
Hartlepool C.B. (No. 21). Teesside C.B. (No. 7). Darlington C.B. (No. 6).

Yorkshire

West Riding (North)
Bradford C.B. (Bradford Moor). Leeds C.B. (Nos. 93 and 94). Huddersfield C.B. (Gedholt-Birkby).

West Riding (South)
Hoyland Nether U.D. (No. 1). Dearne U.D. (No. 7). Darton U.D. (Nos. 15, 16 and 17). Sheffield C.B. (No. 22).

North Western

South Lancashire and North-East Cheshire
Farnworth B. (No. 5). Salford C.B. (Nos. 19 and 21). Audenshaw U.D. (No. 6). Salt B. (No. 12). Bury C.B. (No. 9). Stockport C.B. (Shaw Heath Cale Green North and South). Middleton B. (No. 10d Langley). Blackrod U.D. (No.3). Hyde B. (No. 8).

Central Lancashire
Rawtenstall B. (No. 4).

Merseyside
Bebington B. (No. 14). Birkenhead C. B. (No. 8).

Midlands

Derby, Nottingham and Chesterfield
Kirkby-in-Ashfield U.D. (Nos. 5 and 6). Derby C.B. (No. 22).

North Midlands
Leicester C.B. (Nos. 28 and 29).

West Midlands
Birmingham C.B. (Nos. 157 and 158). Coventry C.B. (No. 15). Wolverhampton C.B. (No. 15). Sutton Coldfield B. (No. 20).

London

Greater London Boroughs
Sutton L.B. (No. 24). Bromley L.B. (Nos. 13, 14 and 15). Harrow L.B. (No. 24).

Outer London
Dartford B. (No. 11).

Local Authorities Outside the Black Areas

Saddleworth U.D. (No. 2). Peterborough C.B. (No. 2). High Wycombe B. (No. 17). Southampton C.B. (No. 11). Reading C.B. (No. 16). Staines U.D. (No. 12). Wortley R.D. (Grenoside). Burton-upon-Trent C.B. (No. 2). Ramsbottom U.D. (No. 4). Glossop B. (No. 5). Stanley U.D. (Co. Durham). (Dipton No. 2). Rugby B. (No. 14). Grantham B. (No. 19).

SCOTLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Bearsden (Westerton No. 2). Clydebank (No. 7 North and South Drumry). Coatbridge (Coltswood). Edinburgh (Murrayfield/Cramond No. 3 (part 1) and Pilton No. 1). Galashiels (Galapark/Wilderhaugh) Glasgow (Yoker).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Bishopbriggs (No. 3) (Auchinairn/Springfield) Glasgow (Maryhill). Hawick (Lynnwood).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Lanark County (Bankhead and Blantyre (West). Glasgow (Kelvinside). Edinburgh (Pilton No. 2; Murrayfield/Cramond No. 3 (Part 2); Colinton No. 1). Fife County (Glenrothes Nos. 2 and 3).

NORTHERN IRELAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Portadown B. (No. 5).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Ballymena B. (No. 1). Lurgan B. (No. 3). Newtownabbey U.D. (No. 4).

SUSPENDED ORDERS

9 July 1971-31 May 1972

Castle Ward R.D. (part of the area covered by the Castle Ward No. 1. (Newbiggin Hall/Whorlton Grange) Nos. 1-15 (inclusive) Kielder Close; Nos. 11-21 (odd) Etal Lane; Nos. 71-85 (odd) Montimer Avenue; Nos. 7-21 (odd) Buxton Green.

23 July 1971-31 August 1971

Rothwell U.D. (Nos. 13 Outton and Woodleford).

AIR POLLUTION ABSTRACTS

1246 Profile Study of Air Pollution Control Activities in Foreign Countries. First Year Report. U.S. Department of Health, Education and Welfare, National Air Pollution Control Administration, November 1970. This guide is a "working draft", produced at the end of the first year's work on a two-year project undertaken by Esso Research and Engineering Company for the United States Environmental Protection Agency (formerly known as NAPCA). It describes for each country the types of work being done on the control of air pollution, and identifies the organisations active in that field. Information includes the name and address of each organisation, the names of its key employees, the air pollution control fields in which it is active, its special aims, publications and special facilities. Countries surveyed for the study were Austria, Belgium, Denmark, France, Germany, Great Britain, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland and the Soviet Union. A number of international organisations are also surveyed. It is anticipated that the survey will be extended to cover Finland, Greece, Ireland, Spain, Canada and some South American countries this year. Copies are available from the Federal Clearing House for Scientific and Technical Information, 5258 Port Royal Road, Springfield, Virginia 22150, USA, price three dollars a copy. A reference copy can also be seen in the National Society for Clean Air's Library in Brighton.

1247 Nitrogen Oxides: An Annotated Bibliography. U.S. Department of Health, Education and Welfare, August 1970 (National Air Pollution Control Administration Publication No. AP-72). The primary objective of this publication is to collect, condense, and organize existing literature on the nitrogen oxides. Oxides of nitrogen are important to the air pollution problem, since the complex chain reaction that produces smog is initiated by the photolysis of nitrogen dioxide. In sufficient concentrations, nitrogen oxides themselves may be toxic to humans and vegetation. Seven recognized oxides of nitrogen that may contaminate man's atmosphere are listed according to their molecular weight. Of the seven, nitric oxide and nitrogen dioxide are the most commonly encountered because of their relative atmospheric stability and their manner of generation. Generally these two are considered together as atmospheric nitrogen oxides. (NO_x).

1248 A Study of Air Pollution Around a Sulphuric Acid Plant. Fayed, M. E. S., Saleh, M.A., and Otten, L. (J. of Instit. of Fuel, March 1971). This paper presents the experimental results of an air pollution study at a sulphuric acid plant situated near Abou-Zaabal, Egypt. During the course of study, the lead peroxide method (DSIR apparatus) allowed long-term observations, while the iodine titrimetric method was used for rapid concentration measurements. This study is an experimental verification of the expectation that sulphuric acid plants cause high levels of pollution. The observed average SO_2 concentration of 5 ppm is much higher than that near power plants and steel mills. In addition, the influence of factors such as the emitted concentration, wind direction and speed is shown by the concentration contours drawn around the plant. A number of suggestions are made to remedy some of the problems of pollution caused by the sulphuric acid plant.

1249 The Energy Position: Dealing with Change. The Rt. Hon. Lord Robens of Woldingham (J. of Instit. of Fuel, May 1971). The energy situation in the '40s and '50s is taken through to the promise of a four-fuel economy late in the '60s which was never fulfilled. This disappointment was perhaps caused by Government inability to deal with change. In the '40s and '50s energy policy was based on coal; other fuels, such as oil and natural gas, suggested the dawn of the four-fuel era. But the other fuels failed to satisfy the demand. Because fuel policy was no longer based on coal, an overall view was necessary as a first step to the change from a one-fuel to a four-fuel economy, hence the 1967 White Paper. This White Paper is the cause of the present fuel shortage, not because the estimates were wrong, but because of

the inability of the system to keep an eye on the changing situation immediately after the White Paper was published. It is suggested that the remedy to this is to establish an Energy Commission continuously staffed by experts, working in their job a long time, who will continually monitor the energy situation; guide as to desirable changes of policy as the changing situation demands, and bring about co-operation between all the fuel industries, instead of the present in-fighting between different groups, and so give the Minister objective planning advice.

1250 **The Control of Offensive Odours: Results of a Survey.** Ricketts, C. (Environ. Health, J. of A.P.H.I. 79(5) May, 1971). The survey related to local authorities and a 10 per cent sample was taken, since this would give quite significant results and by choosing mainly urban areas the number of these trades covered by the survey would be very representative of the national situation. Offensive trades and odour production are described, together with how the survey was conducted. Odour control methods used are then analysed, described and compared. A list of offensive odour producing trades is given. The author concludes that the most noticeable fact emerging from the survey is the large discrepancy in the amount of control which is applied to offensive odour production operations. Equally disturbing is the range of successful control methods; indicating the need for very careful consideration when choosing a control method for a particular process. The various trade groupings do not show a constant success rate and the author feels that this can only mean that no uniform standards are being adopted throughout the country.

1251 **Control of Atmospheric Emissions from Petroleum Storage Tanks.** Informative Report No 2 T1-3 Petroleum Committee, Air Pollution Control Association. (J. of Air Poll. Control Assoc. 21(5) May, 1971). This report deals with the control of hydrocarbon vapour emissions from petroleum storage tanks. The report presents the theory of evaporation loss from liquids, describes emission control equipment and its maintenance, and outlines techniques used to estimate the magnitude of emissions and their reduction.

1252 **Control of Particulate Emissions from Lime Plants—A Survey.** Minnick, L. John. (J. of Air Poll. Control Assoc. 21(4) April, 1971). Lime has become the world's leading reagent for use in the treatment of both water and air pollution and, after sulphuric acid, is the No 2 basic chemical in commercial use. As a result, the production capacities of the manufacturing plants are being rapidly expanded to meet the increasing demand for liming materials. This paper describes the achievements of the lime industry in developing methods of handling and controlling the various finely divided products which they produce. An extensive survey provides useful data on the availability and performance of many of the control devices that are currently in use, and an analysis is made of the operating efficiencies and costs of this equipment. The environmental control programmes which are currently underway in this industry are described and an evaluation is made of these programmes. The ultimate goals that are believed to be attainable are presented from the standpoint of emission control from individual processes as well as from operating plant complexes. While the paper deals primarily with practical operating and engineering aspects of the subject, some information is also included on methods of tests and the monitoring systems that are in use.

1253 **Asbestos and Air Pollution: an Annotated Bibliography.** US Environmental Protection Agency, Air Pollution Control Office, Research Triangle Park, North Carolina, Feb. 1971. This bibliography contains 160 abstracts of documents and articles on asbestos. An author index, a title index, a subject index and a geographical location index follow the abstracts.

1254 **Global Air Pollution-Meteorological Aspects. A Survey.** Munn, R. E. and Bolin, B. (Atmos. Environ. 5(6) June 1971. This is a very detailed survey dealing with diffusion and transport rates; pollution sinks; climatological considerations; atmospheric monitoring for pollution; and the effect of pollution trends on climate. The authors conclude that this survey has indicated that our present knowledge of diffusion and sink mechanisms on the regional and global scales is still inadequate. To answer the questions posed by engineers and politicians, therefore, additional large-scale studies of the behaviour of atmospheric pollutants are urgently required. We need experimental data as well as realistic models, not only to assess present conditions but also to predict future trends in degradation of the "Global village". The authors hope that this review will serve to stimulate such activity.

OBITUARY

William Robert Martine

It was with profound regret that we had to announce in the last issue of *Clean Air* the death of Dr. W. R. Martine who was killed in a motor accident on Monday, 3 May 1971.

Dr. Martine was born on the 9 June 1898, at Edinburgh. He was educated at Fettes and the University of Edinburgh. He served with distinction in both World Wars and attained the rank of Colonel in the Royal Army Medical Corps (T.A.). He was Mentioned in Despatches and awarded the Territorial Decoration with 4 Bars. In 1945 he was made an Officer of the Order of the British Empire.

He had many activities in the public health field, but had a special interest in the cause of clean air. For many years he represented the British Medical Association on the Council of the National Society for Clean Air, but was also a very active member of the West Midlands Division of the Society. Dr. Martine was a Past Chairman of the Executive Council and at the time of his death was a Vice-President of the Society. For many years also he had been Secretary of the West Midlands Joint Advisory Council for Clean Air and Noise Control. He was a keen and accomplished fisherman; but above all he was a kindly gentleman who had the interests of his fellow human beings very much at heart.

AIRBORNE PARTICLES

A rear-window sticker read: "This car is kept efficient through . . ." and then followed the name of a do-it-yourself magazine. The numberplate could scarcely be seen for exhaust smoke.
Glasgow Herald. 12.6.71.

The smog was so bad in Los Angeles that members of the Dodgers baseball team had to keep taking oxygen during their game with Houston.
Daily Mail. 22.6.71.

The GLC is pressing Whitehall for tough action on car exhaust fumes in a bid to clean up the atmosphere. Its Strategic Planning Committee wants the Government to include an exhaust check in the MOT test. It also wants a ban on exhaust systems made from an easily corroded material and ventiliation systems which allow heavy concentrations of fumes to enter vehicles.
Evening News. 19.7.71.

The breathing of 48 pupils at Aberdare and Mountain Ash will be tested continuously next year to discover the effects of atmospheric pollution, particularly from the National Coal Board's Phurnacite smokeless fuel plant at Abercwmboi.
Western Mail, Cardiff. 3.7.71.

Marathon runners at next year's Munich Olympic Games will not have to run through fume-laden streets. The city authorities have agreed with the Olympics organising committee to ban motor traffic from the streets used by the runners for three hours before the start of the race.
Bolton Evening News. 9.7.71.

Too much sulphur dioxide in the atmosphere could cause chewing gum made in a Plymouth factory to lose its flavour, the Millbrook power station Inquiry heard today.
Western Evening Herald, Plymouth. 6.7.71.

Within a year, two-thirds of Ford engines will be sold with carbon monoxide and hydrocarbon emission controls as standard. The remainder will be converted on a total production basis as soon after that as practicable, but certainly within two years.
Service Station. July, 1971.

A leading Greek archaeologist warns that the famed Parthenon "is in danger of turning into sand from industrial carbon monoxide fumes". Spyros Marinatos, who has frequently called upon the government to act to save the country's ancient monuments, said another danger threatening the marble temple was the huge crowds flocking to see it.
Christian Science Monitor, Boston. 17.6.71.

Kirkcaldy Technical College is leading the field in Scotland by becoming the first examination centre in the country where students can gain their diploma in Air Pollution Control. Six students from the College have just achieved their diplomas after spending two years in part-time evening study undertaken while still holding down their normal jobs.
The Fife Free Press. 7.6.71.

Hair clipped from incoming midshipmen at the United States Naval Academy will be used in a pollution research project. After their first Navy haircuts, clippings from each of the 1,250 midshipmen will be packed in plastic bags and sent to the University of Michigan. Researchers at the University's Institute for Environmental Quality will run extensive tests to determine how hair is affected by air and water pollution.
West Lancashire Evening Gazette. 26.7.71.

PHOTOGRAPHS

The Society's library has many photographs of smoke and pollution of former years but needs new photographs of air pollution and its effects today, especially "before" and "after" photographs of new smoke control areas, reduction equipment, etc. The Society would be grateful if any members could send photographs either to be kept in the library or copied and returned.

"ANTINQUINAMENTO '71"

15th-19th November 1971
Milan Fair, Milan, Italy

Conference Programme

Monday 15th November

0.900–15.30 Registration of Delegates.

10.00 Exhibition opens.

10.00 Conference Opening Session
Welcome to delegates and keynote speeches by representatives of the Italian Government, the provincial government of Lombardy, and the city of Milan.

15.00 Pre-view of the Exhibition
Films on the Environment.

18.00 Conference Cocktail Party.

Tuesday 16th November

09.00 Exhibition opens.

10.00 "Environmental Pollution Today—The Scene".
Chairman: Dr. C. J. Jackson.
Distillers Co Ltd—Great Britain.

The Italian Viewpoint.
Ing. S. Cristofoli.
ASSO Lombarda—Italy.

The British Viewpoint.
A. I. Biggs.
Confederation of British Industries—Great Britain.

The French Viewpoint.
Prof. C. Garnier.
Institut de l'Environnement—France.

The Scandinavian Viewpoint.
Dr. L. Bruneau
Sveriges Industriforbund—Sweden.

13.00 Luncheon.

15.00 The German Viewpoint.
Dr. W. Gassler.
Bundesverband der Deutschen Industrie E.V.—Germany.

The International Viewpoint.
W. C. Hopper.
Stichting Concawe.

Brains Trust of all speakers and discussion.

Wednesday 17th November

09.00 Exhibition opens.

Technical Visits.

10.00 "Land Pollution".
Chairman: G. H. Beeby.
President, Society of Chemical Industry—Gt. Britain.

Land Pollution Problems in Gt. Britain.
Dr. D. H. Sharp—General Secretary, Society of Chemical Industry and Institution of Chemical Engineers—Gt. Britain.

The Influence of Refuse on Underground Water.
Prof. Dr. W. Fresenius.
Weisbaden—Germany.

Migration of Oil in the Soil.
Dr. P. C. Blokker.
Stichting Concawe.

Discussion period.

13.00 Luncheon.

15.00 "Noise".
Chairman: Dr. E. J. Richards.
University of Technology, Loughborough—Gt. Britain.
Forecast of Airport Noise Annoyance: Results of French Survey and European Comparisons.
Ariel Alexandre.
Organisation de Cooperation et de Developpement Economiques—France.

Traffic Noise.
FIAT, Italy.

Criteria for Freedom from Noise Nuisance.
Dr. J. A. Langdon.
Department of the Environment — Gt. Britain.

Discussion period.

Thursday 18th November

09.00 Exhibition opens.

10.00 "Water Pollution".
Chairman: Prof. Dr. Edmund Leclerc.
Universite de Liege—Belgium.

Water Pollution Control in England and Wales.
The Present Position.
Dr. B. A. Southgate.
Formerly Director Water Pollution Research —Gt. Britain.

Activated Carbon in the Treatment of Effluents.
Dr. J. L. Blanc.
Techfina—Switzerland.

The Disposal of Chemical Effluents Difficult to Treat.
Prof. Dr. P. Berbenni.
University of Pavia—Italy.

Effluent Treatment in the Tanning Industry.
Dr. G. Pascarella and Dr. N. Mastrorilli
S.N.A.M. Progetti—Italy.

Discussion period.

13.00 Luncheon.

15.00 "Air Pollution".
Chairman: H. Stephany.
VDI-Kommission Reinhaltung Der Luft—Germany.

The Control of Industrial Emissions in the United Kingdom.
F. E. Ireland.
Chief Alkali Inspector, Dept. of the Environment—Gt. Britain.

Air Pollution and its Control in Scandinavia.
A. Sverdrup.
Norges Industriforbund—Norway.

Air Pollution and its Control in Milan.
Prof. Ing. E. de F. Frangipani.
Istituto di Ingeneira Sanitaria—Politecnico di Milano — Italy.

Cleaning of Gases by Wet Methods: Recent developments in equipment.
L. Angyan.
Sczelozomuvek—Hungary.

Discussion period.

20.00 Conference Dinner.

Friday 19th November

09.00 Exhibition opens.

10.00 "Marine Pollution".
Chairman: Sir Kenneth Hutchison, C.B.E., F.R.S.
Amoco—Europe.

Review of Marine Pollutants.
Prof. R. B. Clark.
University of Newcastle upon Tyne—Gt. Britain.

Practical Aspects of the Abatement of Oil Pollution of the Sea.
R. V. Romano.
Institute of Petroleum—Italy.

Discussion period.
followed by
Closing Session.
Chairman: Sir Kenneth Hutchison, C.B.E., F.R.S.
Amoco—Europe.

Review of the Week.
Dr. S. Pampuro.
Montecatini Edison S.P.A.—Milano—Italy.

General Discussion.

Close of Conference.

I wish to receive a Conference Brochure and Delegates Registration Form.

Name: ....

Address: ....

INDUSTRIAL NEWS

Air Products' Exhaust Test Gases Play Major Role in Jaguar's Pollution Research Programme

Air Products Limited has been contracted by Jaguar Cars Limited (a member of the British Leyland Motor Corporation) to supply a complete range of speciality gases for use in its Emission Control Laboratory in measuring the exhaust emission levels on E-type and XJ6 cars. The decision to order gases from Air Products follows the installation by Jaguar of new and more sophisticated instruments in its pollution research programme to comply with the US Federal Government's 1972 regulations covering exhaust emission levels.

Emission control systems became compulsory on all cars destined for the United States in 1968, when the Federal Government announced regulations restricting the levels of car exhaust emissions.

Since the 1968 legislation, the Federal administration has further tightened the standards of permissible exhaust emission, and by 1975 these standards will be 90 per cent more stringent than those which are at present in force.

It is in an attempt to comply with these forthcoming regulations that Jaguar is currently concentrating its emission control research efforts. Complex instruments have been used by the company since testing started in 1968 but the demands of the 1972 Federal regulations are such that Jaguar has found it necessary to purchase equipment that is capable of detecting and measuring gaseous exhaust compounds to even higher standards of accuracy than before. A Beckmann Model 400 flame ionisation detector, specifically designed to detect all hydrocarbons present in an exhaust stream has recently been installed.

A vital part of any systematic gas analysis using precise electronic instruments such as the Beckmann detector is the accurate calibration of the instrument prior to use with standard gases and gas exhaust mixtures. These gases must by definition have a composition of guaranteed accuracy since any major fluctuations in the composition of the gases seriously limits the accuracy and effectiveness of the measuring instrument.

Air Products had previously contracted to supply guaranteed composition cylinders of sulphur hexafluoride in nitrogen. This gas mixture is being used with an electronic leak detector to detect faulty evaporator units which are the heart of the air conditioning system on the company's XJ6 saloon cars for export to the United States.

Reader Enquiry Service No. **71109**

Blue Funnel Co-operate in Atmospheric Pollution Survey

The tons of chemicals poured into the atmosphere on land may be having a serious effect on the environment hundreds of miles out to sea.

This pollution of the ocean by air born particles is being studied by two oceanographers from Liverpool University who are travelling from Liverpool to Japan on board the Blue Funnel cargo liner "Telamon". Blue Funnel is a member of The Ocean Steam Ship Group.

During the seven-week voyage to Japan, the scientists will take samples of the marine atmosphere over large areas and under varying weather conditions using terylene mesh suspended from the bow of the ship. They will also sample the sea to see the effect of the air born pollution on the water.

Said Dr Chester of Liverpool University Oceanography department: "This work will greatly expand our collection of atmospheric dusts in ocean areas. There are problems involved in this kind of study, the major one being that it requires a great deal of ship time in areas which are not often accessible to British oceanographic research ships.

"In view of this, Blue Funnel were approached and allowed us to make collections from their ships on the UK-Japan run. This will allow dust sampling in the North Atlantic, South Atlantic and the Indian and South China Seas."

The two scientists who sailed from Liverpool on "Telamon" on Tuesday, 13 July are 24-year-old Simon Aston and 21-year-old Alan Woodward.

Reader Enquiry Service No. **71110**

British Incinerators for Russia

Two heavy duty chemical waste incinerators worth in all £70,000 have now been commissioned in the U.S.S.R. by the manufacturers, The Incinerator Company Ltd. One plant, at Mogilev, in Belorussia, forms part of the £30 million polyester complex constructed by Polyspinners Limited (CJB, Dobson & Barlow Machinery Sales Limited, with ICI). The incinerator will burn 2,170 lbs per hour of granulator residues, carbon cake, and general wastes, plus 1,470 lbs per hour of liquid residues consisting mainly of Diphenyl, Glycol, DMT and Methyl Benzoate. The second incinerator, part of the £5 million acetic acid plant at Erevan in Armenia, designed by the Power-Gas Corporation Limited, will destroy 1,760 lbs/hour surplus or off-specification succinic acid, and 1,700 lbs/hour of heavy oil with on occasions either heavy ends or other surplus acid. The acetic acid itself will be used for the production of synthetic fibres and organic chemicals.

The incinerator for Polyspinners is a two-cell design. Solid waste is burnt in cell one which is connected by a primary flue chamber (where small drums can be burnt out) to cell two where liquid wastes are destroyed by three burners. One fires DMT at 540 kgs/hour, the other fires granulator residues at 250 kgs/hour, while the third fires all other residues at 125 kgs/hour. The burners are rated to use up to 136 kgs/hour of fuel oil when supplied at a temperature of 115/120°C and a pressure of 25lbs/in^2. Cell two leads into an after-burning combustion chamber fitted with an oil burner to complete the combustion process, if necessary. This burner is controlled automatically to fire only when the temperature in the after-burning chamber is less than 800°C.

The after-burning chamber is connected to a centrifugal two-stage gas washer which prevents the escape of fly-ash and soluble acidic fumes. From here, a horizontal flue conducts the gases to the stack.

The incinerator for the acetic acid plant is also of two-cell design. In addition, there is a chamber for the occasional burning off of waste materials from drums. In the first cell, 1,760 lbs/hour of succinic acid, in crystal form, can be destroyed. The crystals are transported in a container from centrifuges. The container is positioned on a roller runway conveyor along which it is moved to a tipping hoist carriage and secured there. When a button is pressed to raise the hoist, the furnace door opens automatically. After the crystals have been discharged into the furnace, the button is pressed again thereby lowering the hoist and automatically closing the furnace door.

Under normal conditions, cell two destroys 220 lbs/hour of heavy oil, which has been separated out from water in an effluent treatment plant, together with 1,069 lbs/hour of water/oil emulsion which is blowdown from compressors. Under abnormal conditions, however, this cell can handle the same amounts of heavy oil and water/oil emulsions, together with up to 3,520 lbs/hour of heavy ends or up to 2,200 lbs/hour of off-specification acid. The maximum total heat generation from the plant is 40,000,000 Btu/hour.

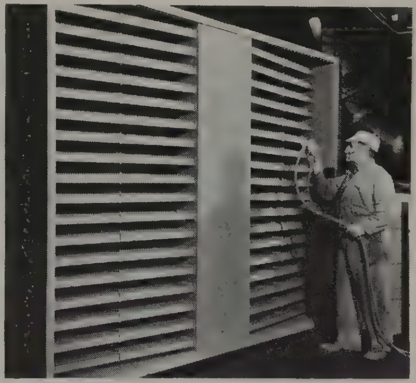
Shut-down of parts or all of these plants occurs automatically if pressure or temperature are outside the working limits, or when there is loss of air flow to burners or failure of the ignition flame.

Reader Enquiry Service No. **71111**

U.K.-Built Self-Cleaning Separators to Provide Clean Air for World's Largest Gas-Turbine Station

Putting the finishing touches to the first three inertial separator assemblies destined for the aluminium smelter under construction at Bahrain in the Arabian Gulf. The assemblies are being constructed by GKN Farr Filtration at its Birmingham works.

When installed the assemblies will remove 90 per cent of all dust of 5-micron (1/5000 inch) size and above and 99 per cent of all dust of 20-micron (1/1250 inch) size and over from the air used to ventilate the turbine house of what is believed will be the biggest gas-turbine station in the world.



Each assembly has a face area of 7 ft. 10¼ in. × 10 ft. 4 in. and is made up of 72 Dynavane cells. Features of the Dynavane cells are: first, complete absence of moving parts to service or go wrong; second, compactness requiring considerably less space than conventional air filters of equivalent capacity; third, self-cleaning action with no filter media to replace or clean; and, fourth, constant efficiency and pressure loss performance under a wide variety of operating conditions.

Reader Enquiry Service No. **71112**

New Aluminium Plant

Anglesey Aluminium, the first large scale U.K. aluminium reduction plant to come on stream, is jointly owned by The Rio Tinto-Zinc Corporation Ltd., British Insulated Callender's Cables Ltd., and Kaiser Aluminum and Chemical Corporation Ltd. These three companies spent £4½ million on pollution control. Their fume emis sion control is believed to be the most stringent in the U.K. The site chosen for this plant is Holyhead on Anglesey. The plant has been built to blend in with the surrounding country-side as much as possible.

Reader Enquiry Service No. **71113**

Another First for Rolls-Royce

A Rolls-Royce Motors truck diesel is the first to pass the new exhaust smoke Standard announced recently by the British Standards Institution.

An Eagle 265 Mk II 12-litre turbocharged diesel manufactured at the Diesel Division's Shrewsbury factory complied with all the strict requirements of the new revised type test, BS AU 141a: 1971—well within the stringent limits on exhaust smoke emission, power and performance.

This certification by BSI gives Rolls-Royce Motors the triple first. In June last year, their naturally aspirated Eagle 205 and 220 Mk IIs became the first engines in the world to pass the former Standard with which very few manufacturers have so far complied. Now they are also the first manufacturer to pass the new Standard and also the first manufacturer to pass either test with a turbocharged engine.

In some cases engine manufacturers have reduced the power of their engines to meet the requirements of the 100-hour long test. Unlike these, Rolls-Royce have been able to uprate the power of the latest engine from 265 bhp to 280 bhp and still pass the test.

The exhaust smoke limits in the new Standard are similar to those framed in the regulations being prepared by the Economic Commission for Europe.

It is likely that the limits adopted will be those specified by the British Standards Institution and met by Rolls-Royce engines.

Although a far greater volume of dangerous carbon monoxide and other toxic gases is emitted from petrol engined vehicles, smoke from diesel powered trucks can be more irritating to a pollution aware public if engine combustion is poor.

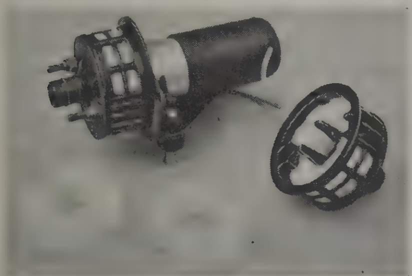
It is the stringent smoke limit set by the British Standards Institution that makes their test so difficult to meet. By being the first manufacturer to meet both old and revised Standards, Rolls-Royce Motors Limited can honestly claim that it has taken a further practical step towards reducing atmospheric pollution and niusance to the public.

Reader Enquiry Service No. **71114**

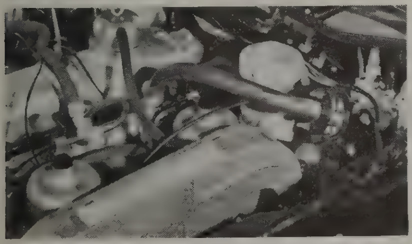
The Day the Sun Got Through

One of Britain's foremost quality car manufacturers to be affected by the American ruling on exhaust emission is the Rover Car Company. They have had to conform to the stringent pollution law on all 2000 T.C. models exported to the States and their ingenious solution to the problem was aided by the technical expertise of air filter manufacturers, Bondina Limited of Halifax.

The problem was that in order to meet the American regulations motor car engines had to be set at a raised idling speed. This increased idling speed unfortunately causes running-on, particularly when the engine is hot and it is during this running-on period that the engine emits a considerable amount of fumes.



To combat this, Rovers designed the anti-run-on valve which utilises three Bondina filter pads for feeding screened air directly into the inlet manifold. This air bypasses the carburettors and is therefore free of petrol vapour, ensuring immediate engine cut-out when the ignition is switched off.



The valve operates on the following principle: An additional circuit is connected to the ignition switch which is only energised when the ignition is turned to the off position. Current then flows via a relay, earthed through an engine oil pressure switch to the anti-run-on valve. The valve opens the inlet manifold to atmosphere, drawing in air which has first been drawn through the Bondina filter pads. This incombustible mixture causes the engine to stop immediately whereupon the oil pressure switch opens, breaking the circuit, and the anti-run-on valve closes, completing the cycle.

The valve assembly is just 2½ in. in diameter, is of nylon construction and mounted accessibly close to the carburettors. It employs three specially shaped inserts of Bondina P15/500 washable filter material which is serviced every 10,000 miles. The use of employing filtered air is of vital importance as dust in the atmosphere would be admitted directly into the engine—causing excessive wear to cylinders, pistons, piston rings and bores. The use of Bondina filters in the valve therefore, ensures that the danger of dust getting into the engine is completely eliminated.

Reader Enquiry Service No. **71115**

New Automatic Filter Range to Better Environmental Conditions

Miracle Mills Limited, who have been manufacturers of static filters for many years, announce the introduction of a new range of automatic filters for industrial ventilation systems and manufacturing processes. With more emphasis now being placed on better environmental conditions, the necessity of more efficient dust collection especially during plant on-load conditions, becomes of paramount importance.

The new range comprises two basic units, the 'Minor' and the 'Major', where automatic on-load cleaning is accomplished by reverse air flushing groups of filter bags at a time, without restricting the operational throughput of the plant to which they may be attached. An additional feature, in certain circumstances, is the possibility of dispensing with the need for reverse air fans. When selected with generous cloth areas, the units require little or no attention on an annual basis.

The 'Major' unit is designed on a modular basis so that any desired quantity of air can be filtered by adding standard increments of length and by double banking. Furthermore, quick release filter bag attachments are incorporated in each type, and the bag lengths can be varied to make each unit more flexible in application.

Reader Enquiry Service No. **71116**

"Tradeswaste" Incinerator Order Placed by Stafford

An incinerator which will dispose of waste as bulky as old three-piece suites, car tyres and mattresses has been ordered by Stafford Borough Council from Hodgkinson Bennis Limited of Little Hulton, Manchester. Designed and developed specially for Stafford by the Lancashire company, the Hodgkinson Bennis Tradeswaste Incinerator will consume large items without prior breaking-down and can be operated by one man. It will be installed by Hodgkinson Bennis engineers and will dispose of up to ten tons of bulky waste per eight-hour shift.

The Tradewaste Incinerator is designed to work alongside existing council waste disposal units so that councils can offer this additional service to private individuals and industries with bulk disposal problems.

Working at temperatures of 2000°F the Tradeswaste Incinerator is fitted with oil-fired after burning equipment which burns off all volatile gases in a secondary incineration chamber. The gases pass through a water trough which traps any floating particles.

The Tradeswaste Incinerator has two force-draught fans. The first forces air under the grate in the primary incinerator; the second aids combustion of volatile gases in the secondary incinerator by infusing additional oxygen. The Tradeswaste Incinerator, of course, meets with the requirements of the Clean Air Act.

Reader Enquiry Service No. **71117**

For Ambient Air Levels of Fluorides

A new fluoride analyser measures automatically amounts of gaseous fluorides in the atmosphere down to less than 0·001 ppm. Designed for unattended operation over periods of more than seven days, it records in units of μgm/m^3 or ppb. Outputs can go direct to chart recorders, alarm systems, teletypewriters, printers and computers. This instrument is to be marketed in Britain and Europe by Epsylon Industries Ltd.

Phosphate fertiliser plants, aluminium smelters and certain incineration, brick, chemical, steel and glass works all produce gaseous fluorides which may be allowed to escape to the atmosphere. Fluoride in its several forms particularly hydrogen fluoride and silicon tetrafluoride can be lethal to plant and dangerous to animal life in areas close to this type of works. Constant vigilance is required to ensure that escaping fluorides do not exceed certain Maximum Permissible Concentrations (MPC). A level recommended by the U.S. Governmental Industrial Hygienists for

human exposure during a normal working day to hydrogen fluoride is 3·0 ppm (chlorine is 1·0 ppm). This standard is accepted in Britain. The U.S.S.R. sets a smaller ppm minimum standard. Over a long period plant life is affected by fluorides in concentrations as low as 0·005 ppm.

Developed from a Mk 1 analyser, designed and developed by Leigh Instruments Ltd, Ottawa and now in service in North America, the new instrument, using solid-state circuits, employs a dry-tube absorber with a thin film of sodium carbonate on its walls. A measured flow of air deposits gaseous fluorides on to this coating which is later detected by a colourmetric solution in a dual cell photometer. All functions of the analysis are automatic.

For readings which have to be taken at scattered points in an area, a low-cast satellite sensing unit is available for sampling. Its dry tube absorber is easily removed for rapid interpretation in the Fluoride Analyser. Tubes are automatically recoated for further use. This technique of remote field sensing is an efficient and economic method of collecting data for constructing isofluors on a day-to-day basis.

Reader Enquiry Service No. **71118**

Mobile Laboratory Aids Air Surveys

Continuing air quality surveys conducted by the Gulf Canada Research and Development Centre, Sheridan Park, Ont., in the vicinity of the company's Clarkson refinery were supplemented this summer using a mobile air conservation laboratory on loan from Gulf Research and Development Company in the U.S. The 10-ton van, which included sophisticated meteorological equipment, some of it atop a 24-foot mast, gathered information and made on-the-spot analyses and evaluations of potential air pollutants in relation to local weather conditions and topography.

Reader Enquiry Service No. **71119**

Laboratory of the Government Chemist Open Days 1971

The Laboratory of the Government Chemist will hold its Open Days on 20 and 21 October. The Laboratory will be open from 1.30 p.m. to 4.30 p.m. on Wednesday, 20 October, and from 9.30 a.m. to 12.30 p.m. and 1.30 p.m. to 4.30 p.m. on Thursday, 21 October.

The work on show will be largely concerned with environmental aspects of the Laboratory's services to other Government departments. The work of the divisions concerned with food and nutrition, agricultural materials, radiochemistry and water and health services will be prominent, including displays concerned with food additives and contaminants, vitamins, pesticides, effluents, drugs and medicines, dental materials and bacteriology.

There will also be contributions from the Customs, general chemical and research divisions, including the analytical examination of beer, tobacco, hydrocarbon oils, minerals and industrial atmospheres, and recent developments in the automation of analytical methods.

Tickets, free of charge, can be obtained from:

Dr. D. C. Abbott,
Laboratory of the Government Chemist,
Cornwall House, Stamford Street,
London, S.E.1.

New Incineration Plants for Bristol and Wolverhampton

Contracts have been awarded to Motherwell Bridge Tacol Ltd., for the complete mechanical and electrical equipment for two more large refuse incineration plants, bringing the Company's order book value for modern moving grate type plants to well over £4,000,000.

Both installations incorporate 'System Dusseldorf' roller grate type incinerator units, similar in design to those operating at Middleton, Glasgow and Edmonton (G.L.C.) The 'System Dusseldorf' incinerator is manufactured under an exclusive U.K. licence from Vereinigte Kesselwerke A.G. (V.K.W.) of Dusseldorf.

Bristol—The plant incorporates two complete incineration flowlines, each rated to handle 15 tons per hour of refuse. In some instances up to 2 tons per hour of the input may comprise old vehicle tyres. The plant is being installed at Avonmouth and the scheme is promoted by the County Borough Council, who appointed Merz & McLellan as Consulting Engineers for the project.

Wolverhampton—Two incinerator units, each rated to handle 10 tons per hour of refuse, from the nucleus of this plant, which is being installed at the County Borough Council's Crown Street Depot.

The Consulting Engineers for the scheme are W. S. Atkins & Partners.

Both installations will include electrostatic precipitation equipment designed to ensure a maximum emission to atmosphere of 0·1 grains of dust per cubic foot of dry gas at N.T.P.

Reader Enquiry Service No. **71120**

N.W.G.B. Commercial Change

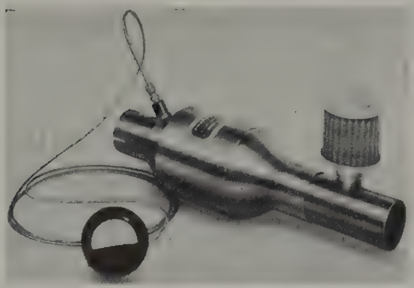
Mr. John E. Funk, of Caryl Road, Lytham St. Annes, Lancs., commercial manager of the North Western Gas Board's West Lancashire group based at Blackpool, is to retire on 28 August, after 48 years in the gas industry. He will be succeeded by Mr. Richard A. W. Hollingdale, of Framingham Road, Sale, Cheshire, for many years the Board's solid smokeless fuel sales manager and more recently raw materials purchasing officer.

Mr R. A. W. Hollingdale

Mr Hollingdale joined the Board in 1952 as deputy coke officer, and in 1959 was appointed coke officer, a designation later changed to solid smokeless fuel sales manager. Before joining the Board he was South Western Division coke sales manager of the National Coal Board and previously worked for Coal Distributors (South Wales) Ltd, at Cardiff.

Mr. Hollingdale has recently become chairman of the North Western Division of the National Society for Clean Air, and is a member of the Council of the Society. He is married, and has two sons, the younger of whom is employed in the Board's accounting department.

Ford Choose Engelhard Exhaust Purifier



Ford vehicles sold in California during 1974 will be fitted with catalytic exhaust gas purifiers manufactured by the Engelhard Minerals and Chemicals Corporation.

EMC announced on Tuesday, 1 June 1971, that an arrangement had been made with the Ford Motor Company covering the supply of its PTX platinum catalytic converters for the control of carbon monoxide and hydrocarbons from automobile exhaust emissions. Under this arrangement, Engelhard will supply Ford's requirements for these devices for 1974 models sold in California, where new emissions control standards become effective in that year.

The Engelhard PTX unit is the result of long term research into uses of platinum group metals for controlling atmospheric pollution. Extensive testing, including use of prototype converters in the 1970 Trans Continental "Clean Air Car Race", has demonstrated that the device is a practical and effective method of meeting the 1975 Federal standards for control of carbon monoxide and hydrocarbon emissions from vehicles operating on non-leaded gasoline.

Reader Enquiry Service No. **71121**

Air Pollution Control in Transport Engines

A conference on Air Pollution Control in Transport Engines is being organised by the Automobile Division of the Institution of Mechanical Engineers and the Combustion Engines Group. The conference will be held in November 1971 and will cover gasoline, diesel and gas turbine engines on land. Further information may be obtained from: Automobile Division, Institution of Mechanical Engineers, 1 Birdcage Walk, London S.W.1.

Boilerhouse Supervisor Courses

Lower management has been sadly neglected in the plethora of courses now being held, but this was rectified to some extent at a three-day course at Sutton Coldfield arranged jointly by the Combustion Engineering Association and the College of Fuel Technology. The subject for the course was the supervisor's job in relation to boiler plant.

The programme developed two main themes—" Operational Planning and Control " and " Management Responsibilities "—and was presented by a team of speakers drawn from Industry and the Engineering Industry Training Board.

This highly successful course is to be repeated in London in November. Full details from:

The Combustion Engineering Association,
Beaufort Chambers,
240B High Street,
Slough, Bucks.

Meeting of Clean Air Advisory Councils

Arising from a suggestion by Mr. J. Winfield—a former Member of the Council of this Society—the West Riding Advisory Council for Clean Air and Noise Control invited all the known counterpart Clean Air Advisory Councils in the country to a one day meeting in Leeds. Delegates from the Manchester and District Regional Clean Air Council, Derbyshire Clean Air Council, Warwickshire Clean Air Council, West Bromwich Clean Air Council, Sheffield and District Clean Air Committee and the Midlands Joint Advisory Council for Clean Air and Noise Control attended the meeting which was held in the Civic Hall, Leeds, on Thursday, 6 May 1971.

The Chair was taken by Mr. W. Jennings, Chief Public Health Inspector, Brighouse, Chairman of the West Riding Advisory Council.

It is understood that this is the first time that such a meeting of Advisory Councils has been held in the 36 years the West Riding Council has been in existence.

The meeting discussed the constitution, organisation, scope and usefulness of Clean Air Advisory Councils, the future exchange of information and publicity material, together with other current problems of Local Authorities in connection with Clean Air.

At the termination of the meeting it was agreed that the conference had been most successful and that a similar conference should be held in not less than twelve months time, possibly in the area of the Derbyshire Clean Air Advisory Council.

Environmental Pollution Science

Brunel University will be offering a part-time Master of Technology course in Environmental Pollution Science, beginning in October 1971. The course, which will extend over two academic sessions, is being organised jointly by the Departments of Biology and Chemistry; it will consist of lectures, seminars and related practical instruction, and work on a research project is part of the course requirements.

The course is intended to provide a comprehensive treatment of the sources, biological effects, detection, and control of environmental pollution, including legal aspects. It is designed to give a broad perspective of the total problem, with deeper technical consideration of areas selected for special study.

The course should interest and benefit those working in the chemical manufacturing industries and who wish to learn the importance of controlling industrial effluents; those working in industries engaged in devising and producing the means of combating such effluents; and those working in Government and public services.

Applicants will normally be expected to have a degree in either chemistry or biology, but persons having an equivalent professional qualification may be considered.

Further information is obtainable from either Prof. G. C. Bond, Chemistry Department, or Dr. A. J. Lacey, Biology Department, Brunel University, Woodlands Avenue, Acton, London W3 9BX.

Dust Control and Air Cleaning Exhibition

Methods of solving pollution problems involving dust and fume emission encountered in every industry and currently costing British firms alone over £32,000,000 per annum will be offered in abundance at the Dust Control and Air Cleaning Exhibition, Olympia, London, on September 28th to October 1st, where every aspect of industrial air cleaning is covered.

Second in the Series, the Exhibition attracts visitors from all over the world to inspect the most sophisticated new equipment designed specifically to combat these hazards to health and the environment.

Among the exhibitors will be the following members of the National Society for Clean Air: American Air Filter (GB) Ltd, Northumberland; Chemical Construction (GB) Ltd, Twickenham; Dust Control Equipment Ltd, Leicester; Dust Suppression Ltd, Hemel Hempstead; Provenair Ltd, Waltham Cross; Uop-Kavag Air Correction Co Ltd, London and Western Precipitation Division, Joy Manufacturing Co (UK) Ltd, Epsom.

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incorporating "Smokeless Air"

WINTER 1971

VOL. 1 NO. 4

PRINCIPAL CONTENTS

PRICE 30p

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Vol. 1 No. 4 **Winter 1971**

Principal Contents

Index to Advertisers

CLEAN AIR is published quarterly by the National Society for Clean Air at 134/137 North Street, Brighton BN1 1RG. Tel: Brighton 26313.

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CLEAN AIR

Local Government Reform

On the 4th November, Mr. Peter Walker, Secretary of State for the Environment and Mr. Peter Thomas, Secretary of State for Wales, introduced the Bill to implement a major reform of local government in England and Wales. Although the proposed changes had been outlined in a White Paper published in February last, it was known that a number of proposals from local authorities and other interested bodies—among them this Society—for changes in the government's draft had been submitted. Sixty proposals for changes over areas and names have, for example, been accepted. Nevertheless, the Bill will bring to an end the present system of single tier County Boroughs and two tier administrative Counties and County districts on the 1st April 1974. In their place, the Bill establishes a new pattern of local government based on two levels of operational authorities—Counties and Districts—throughout the country. Forty-four new counties are proposed, including six "Metropolitan Counties" in predominantly urban areas. The new counties will be divided into districts, and although the district and Metropolitan counties are defined in the Bill they will be named after local consultation. Districts elsewhere will be defined and named on the advice of a new Boundary Commission which will be set up under the Bill.

It is the government's intention to maintain the traditional attributes and dignities of boroughs, and although existing boroughs will cease to exist on the 1st April 1974, the Bill allows any District Council to apply for a Royal Charter of Incorporation after it has been elected. Special provision is also made enabling a district to use the style "Borough" and the title "Mayor". It will therefore be practicable to preserve the continuity of borough status.

These changes, however, are bound to have some effect on the Society so far as local government membership is concerned. It is as yet too early to know in any detail what these changes may be, but the position is being closely watched by the Council; and it may be that in the course of time, it will be necessary to make some Constitutional changes within the Society itself.

However, one change that was forecast in the White Paper has not been included in the Bill. In the White Paper it was proposed that the top tier authorities, that is the Counties, should be responsible for clean air. Although there were some within the Society who considered that this proposal put the responsibility for clean air at the proper level, the bulk of the opinion within the Society was that responsibility for clean air should remain with the Districts. In other words, that the responsibility for implementing the Clean Air Acts should remain with those who have been doing just this for the past 15 years. Obviously the submissions made by the Society and other interested bodies have had the necessary effect, for the Bill now states that although County Councils will be responsible for refuse disposal and the Districts for refuse collection, most other environmental health functions will be District functions and amongst these is included clean air.

What is now important to realise is that "clean air" means very much more than smoke control, although smoke control is a very essential and important part of the whole. Later in this journal is published the text of the Opening Address which Sir Eric Ashby, the Chairman of the Royal Commission on Environmental Pollution, gave to the Opening Session of the Society's Annual Conference at Folkestone. In this address Sir Eric makes it quite clear that there is still plenty of work for the Society to do, but he also makes it very clear that to do this the Society will have to widen its scope and broaden its horizons. The new District authorities will have to do the same and it will be up to the Society to help them to do this by every means at their disposal. This in turn may well mean that the Technical Committee of the Society must be strengthened is such a way that, through headquarters, it can provide technical help and advice to membership on a much bigger scale than hitherto.

FOLKESTONE CONFERENCE

When it became necessary to alter the date of the Folkestone Conference from the middle of October to the first week of November, there were some misgivings that this might have an unfortunate effect on attendance and that the weather might be, to say the least inclement. In the event, any prophets of doom were completely dumbfounded. The weather was brilliant until just after the Closing Session, and there were in fact more full time registrations than last year. It is true that there were fewer day registrations than in 1970, but this was possibly because Folkestone is some distance from London and is not very near an industrial area.

The general opinion seems to be that the Conference was successful and enjoyable. The papers presented were of a high order and certainly moved out into new fields. The interest displayed by delegates was marked and all sessions, including the last session on the Friday morning, were very well attended and discussion was lively. The various visual and audio aids generally worked well—the jamming of the film at the start of the Thursday afternoon session being the one real exception—and at times, taxed the electrical resources of the Leas Cliff Hall. On the Thursday afternoon there were no less than two film projectors, one slide projector, two tape recorders, one amplifier, one extra loudspeaker and the public address system installed in the hall, all in use more or less at the same time.

The Mayor of Folkestone, Councillor John Jacques, started the proceedings by welcoming everybody at the Opening Session. What was especially pleasing was that he made many of the visitors from abroad welcome in their own language. The Conference was opened by Sir Eric Ashby, F.R.S., the Chairman of the Royal Commission on Environmental Pollution. Sir Eric's very fine address set the tone for the whole week's proceedings. He left no one in any doubt that there was still much work for the Society to do, but that to do this it would be necessary for the Society to broaden its horizons. Sir Eric's address is published in full in another part of this journal, as is the Presidential Address of the new President, Mr. Stanley E. Cohen, C.B.E.

There was no Open Session this year and the Wednesday afternoon was devoted to technical and social visits and to the golf and tennis tournaments. One new departure was the inclusion of a purely social visit for both ladies and gentlemen to Canterbury. That this was welcomed is evidenced by the fact that some 90 people enjoyed an afternoon at Canterbury Cathedral followed by tea at the County Hotel, even though there was a scare that a bomb had been placed in the crypt of the Cathedral just after the party had left.

At the time of writing, immediately after Conference, the Society has received reasonably good press coverage from national and local papers. Technical and trade press coverage is not yet fully known because many journals which give detailed coverage of conference papers have not been published yet. On Friday, 5th November, Southern Television recorded an interview with Professor T. J. Chandler, and Radio Brighton broadcast an interview with Mr. A. J. Clarke on Wednesday, 3rd November.

Two visits were organised for the ladies: on the Tuesday afternoon a party visited the factory of Batchelors Foods at Ashford and on the Thursday a party made a visit to Rye. From reports received from participants these were most enjoyable.

There was only one technical visit this year and that was to the Central Electricity Generating Board's nuclear power station at Dungeness. A party of 60 headed by the President made this visit; and had more places been available, it is quite clear that many more would like to have gone. The visit was most informative and enjoyable.

Before touring the "A" Station, the party were given a short talk by the Deputy Station Superintendent on the various features of the "A" Station compared with those of the "B" Station. At "A", two Magnox reactors with a heat output of 840 MW each produce a nett output of 550 MW to the grid. The two reactors at the "B" Station, each with a 1450 MW heat output will produce a nett electrical output of 1200 MW. It was stressed that the reactor was a totally enclosed unit and no fission products could enter the coolout carbon dioxide, which provides the heat for the steam raising boilers, and no emissions to atmosphere were possible. After a question period, the delegates were divided into parties and were shown over the "A" Station.

In glorious sunshine on the afternoon of Wednesday the 3rd November, 28 golfers from the Society set off for the Sene Valley course of the Folkestone Golf Club to compete for the annual Solid Smokeless Fuels Federation trophy. The competition was won by Dr. B. Leadbeater of I.C.I. who returned a Stableford score of 41 points. Considering that Dr. Leadbeater was playing in slippers with borrowed clubs this was no mean feat. Presumably the secretary of his home club has been informed so that his handicap may be adjusted accordingly! The runners-up were Mr. L. Eastwood of Rotherham and Mr. W. Meredith of Portsmouth. The cup and tankard were presented to Dr. Leadbeater by His Worship the Mayor of Folkestone at the Conference Dinner on the Wednesday evening.

The party ready to leave for Canterbury.

Arriving for the Dinner and Dance.

The Dance.

The Dungeness Party.

The Mayor presents the SSFF Golf Cup to Dr. Leadbeater.

The tennis tournament, the second one as this was only started last year, was played in ideal conditions at the Folkestone Sports Ground, Cheriton Road. It was encouraging that more players turned out this year and it was pleasing to have Mr. Cor Verheooven, a delegate from Holland, taking part.

The games on the whole were very even although the winner, Mr. Derrick George, Deputy Chief Public Health Inspector to the Hinckley U.D.C. found little difficulty in taking the honours for the second year running.

As an additional activity this year a squash tournament was held at Folkestone's modern sports centre at Radnor Park Road. A strong contingent from the University of Sheffield, Drs. Arrowsmith, Hanby and Hedley, joined in two hours of energetic and entertaining competition which ended in the honours finally going to Mr. G. W. Aston, Deputy Chief Public Health Inspector of the Walton and Weybridge U.D.C.

The social programme was not neglected and started on the Monday evening with an informal gathering at the Leas Cliff Hall. On the Tuesday evening the Mayor and Corporation of Folkestone entertained delegates to a dance and cabaret which was most enjoyable. Perhaps the highlight of the evening was the cabaret in which some delegates took part, among them being the Chairman of the Executive Council!

On the Wednesday evening, the Conference Dinner and Dance was held at the Grand Hotel. Some 160 people attended and the principal guests were the Mayor and Mayoress. This was a very happy and colourful occasion. The dinner was excellent, and the speeches were of a high standard. Afterwards, there was comfortable room for dancing—energetic or otherwise—in the hotel ballroom to a good band.

On the Thursday evening the Chairman of the Executive Council, Mr. Stanley Cayton, M.B.E., gave the customary reception at the Grand Hotel and this again was a very pleasant function.

A Breath of Spring

"A Breath of Spring" is a new 16mm colour film made for the Air Conditioning Advisory Bureau, which is sponsored by the Electricity Council. It deals with the advantages of air conditioning in High Street shops, pubs and restaurants. The film investigates the effect of air on people—its effect on their comfort, convenience and concentration. It shows how people can be more aware of conditioned air and how they can take advantage of the benefits of air conditioning by shopping in air conditioned shops, eating in air conditioned restaurants and drinking in air conditioned pubs.

"A Breath of Spring" records the comments of proprietors and managers of premises which are conditioned and shows how easily air conditioning equipment blends with decor, automatically monitoring and controlling comfort in summer and winter. The film is not technical and although it starts off with some excellent shots of air pollution in our city streets it is mainly for screening to owners and managers of shops and restaurants through Area Electricity Boards and local organisations such as Chambers of Commerce and Rotary Clubs.

The film was directed by Bert Wilkins and runs for 18 minutes. It is available on free loan from the Electricity Council Film Library, Trafalgar Buildings, 1 Charing Cross, London, SW1A 2DS.

Christine Smith

FOLKESTONE CONFERENCE

Opening Address

by

Sir Eric Ashby, F.R.S., D.Sc., M.A.

Chairman, The Royal Commission on Environmental Pollution

I notice that austerely technical conferences, like this one, follow a familiar pattern. They meet at the seaside, even if they are not concerned with clean air. They provide a programme to keep the ladies agreeably occupied. They end with a dance. And they arrange for the proceedings to be opened by someone who can't possibly compete in expertise with the main speakers, but who can be relied upon to deliver one of those graceful speeches which evoke a warm response from the heart, but which make no demands on the intelligence. Well, I shall do my best.

The record is so successful that the Society must be in some embarrassment, like anti-slavery societies after the General Abolition Bill was passed by Parliament. So, as you work yourselves out of a job, the newcomer looks with interest to see how the Society can continue to promote its aims. In this, too, the Society is obviously successful. I see that this conference embraces noise and smell, both important forms of pollution, and both inadequately controlled. And, when you have succeeded in helping to bring these under control, there are still plenty of problems for future conferences.

My first remark certainly comes from the heart. It is to congratulate the Society on its achievements in the 72 years of its life. I am—as many of you know—a newcomer to the field of pollution (though I was an ecologist as long as 40 years ago, when the public didn't know what an ecologist was). As a newcomer, I find that the clean air policy of this country is something to be proud of and the recent improvements quite astonishing; in London, for instance, and Sheffield. I think four influences are responsible for this improvement: the work of your Society; the scientific work done at Warren Spring Laboratory and elsewhere; the tactful control exercised by the alkali inspectors and by health inspectors in local authorities; and (we must give credit where it is due) the scare caused by the London smog in 1952.

For instance, the air carries some pollutants which do not become dangerous until they get into rivers or the sea. DDT is an example. It is estimated (through analyses of the DDT content of rain) that 24 thousand tons of DDT—about a quarter of the total production—are carried into the seas not through rivers but from the atmosphere. A recent report on the study of critical environmental problems asserts that the atmosphere is the major route for the movement of DDT (and other pesticides) into the sea, where, as you know, they accumulate in the bodies of living things. Lead, too, reaches the sea from the atmosphere in large quantities (it is estimated that 350,000 tons of tetraethyl lead are released into the atmosphere in the northern hemisphere every year). And there is interesting circumstantial evidence

that the metal load in some rivers may come as much from the atmosphere as from effluents from sewers. The loads of certain metals in the river Tame (zinc, copper, nickel, chromium, and cadmium) exceed the effluent loads emptying into the river by something like 50 per cent. Thus the mass flow of metal ions in effluents emptying into the Tame was 1·379 tons, but the mass flow of metal ions in the Tame itself was nearly twice as much: 2·654 tons. Where did the other 1·275 tons come from? The most likely source is the atmosphere.

There are other mysteries awaiting solution. All of us are concerned about car emissions. We all know that carbon monoxide is a nasty poison. It is the most abundant gaseous pollutant in the atmosphere—over 200 million tons a year are released. Yet it is not accumulating, as carbon dioxide is, and nobody quite knows why. The background concentration remains about the same, at 0·09 ppm. It seems that the scavengers may be plants and bacteria.

Finally (and it is time I stopped anyway) there is the major unsolved problem of air pollution, namely the effects on health of long exposure to low concentrations of substances (some of them not yet even identified). Good work is being done on this but the answers are still a long way off. The last report of the Council for Environmental Quality in the U.S.A quotes the Environmental Protection Agency there (E.P.A.) as saying that the economic cost of human mortality and morbidity from all air pollution in the U.S.A. is $6 billions annually; and these costs relate only to medical care and work-loss. They are figures which can be disputed (and this, too, is an argument for more research on the economics of pollution about which we know practically nothing), but even if they are wrong by an order of magnitude, they constitute a challenge to public opinion and to those who mobilise public opinion to protect the environment. Another serious gap in our knowledge is the general debilitating effect of polluted air on the growth of plants. Anyone who worked (as I did) 25 years ago in a garden in Manchester and also in Cheshire, did not need to be told that although polluted air doesn't kill some plants, there is what the biologists call "cryptic damage" which is persistent and serious, especially to forest trees.

There are still, let me assure you, great areas of uncertainty in the understanding of the long-term effects of air pollution. We need global monitoring of carbon dioxide; we need to study the transport of sulphur dioxide (I'm sure that this Society is familiar with the fact that the rain over Scandinavia is becoming more acid, and that—though it is unproven—there are suspicions that it might be our sulphur dioxide which is causing this.) We do not know what effects the oxides of nitrogen may have in the upper atmosphere. So there is plenty more for the National Society for Clean Air to do.

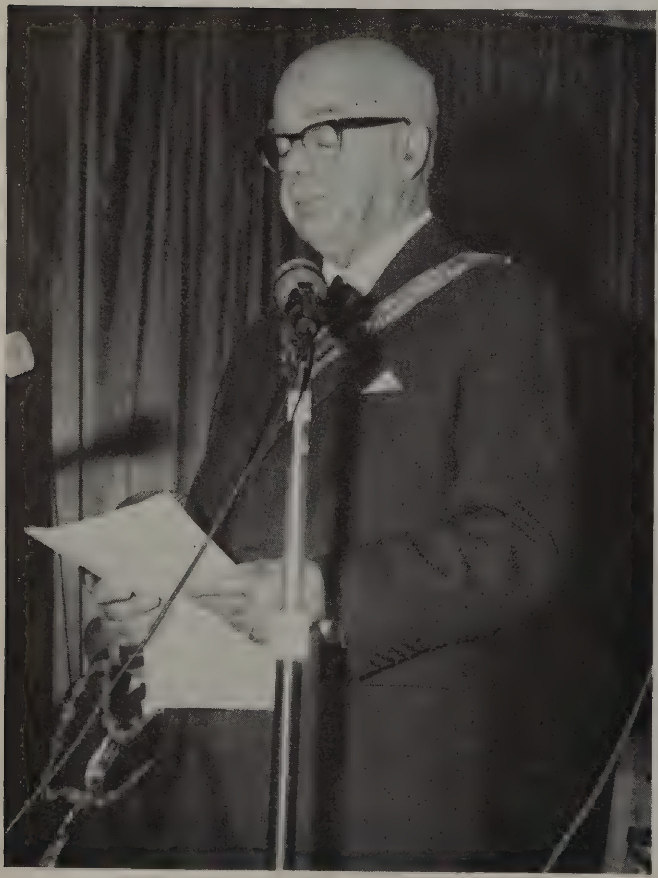
It is a great pleasure, therefore, to be here today as your guest, and I now have great pleasure in putting you into the hands of your President.

FOLKESTONE CONFERENCE

Presidential Address

by

Stanley E. Cohen, C.B.E., C.C.



First of all I wish to express my gratitude for the privilege and great honour of being elected President of this Society. The honour is enhanced for me by succeeding such distinguished predecessors; and when one recalls the immortal name of my friend, Sir Hugh Beaver, our President eleven years ago, one obtains, as Lord Cohen of Birkenhead graciously said in his Presidential Address in 1961, a measure of the prestige of the Presidential chair of the Society. It was, therefore with a feeling of humility and great pride that I accepted the Council's invitation to this office. Perhaps they did not, nor did I, realise that I should have to inflict on you an Address of some length of my own composition; and before such a knowledgeable audience as this, I speak with some trepidation. Further the many friendships I have made during the 14 years Treasurership of this Society have sustained me enormously in that task, and will, I hope, continue to do so during my present term of office.

Now, may I give you, Sir Eric, on behalf of this assembly, our warmest thanks for your excellent and interesting Opening Address. Most of us will have read the First Report of the Royal Commission of which you are Chairman, and cannot but feel that the problems connected with Environmental Pollution in general, are in masterly hands. Your speech, coupled with those of my predecessors, makes my task all the more difficult for fear of repetition, although it is not altogether unprofitable to continue to look at problems which have been referred to before in order to see what progress has been made or has still to be made. Indeed, the Conference Committee is to be congratulated on this week's pro-

gramme, highlighting as it does new subjects to be expounded and discussed, as we, in concert with our colleagues in other countries, go forward in our endeavours to bring to our people the enjoyment and birthright of clean air.

The tragic event in London 1952 led to the appointment of the Beaver Committee and the Report of that Committee led to the Clean Air Act of 1956. Why is it that so often a crisis has to occur before nations take action? Does mankind still stand condemned by the words of Albert Schweitzer?—" Man has lost the capacity to foresee and forestall. He will end by destroying the Earth." So far as this Society is concerned it has given plenty of warning to successive governments and to the public during its 72 years' history, and now that this government is alive to the need for environmental preservation, in concert with other enlightened nations, there is a glimmer of hope that remedial action on a global scale will be taken before it is too late, and we wish you, Sir Eric, every success in your mission to Stockholm next June.

The Washington Clean Air Congress last December which I attended, and where 42 nations were represented by over 2,000 delegates, when a range of subjects was submitted consisting of 543 papers in all, gives us added hope that the research going on all over the world will result in global co-ordination towards the reduction of atmospheric pollution. Preliminary work has in fact been done sponsored by the World Meteorological Office. There appears, however, to be considerable duplication of research as is evident in Warren Spring Laboratory's valuable published abstracts, and perhaps one of the benefits of United Nations activity will be the co-ordination of research and experiment thus reducing, among other benefits, substantial engineering and other costs.

During this week we may hear a reference to the subject involved in Harrison Brown's projection (referred to in Professor Borin's Paper on Carbon Dioxide) of Fossil Fuel Consumption in the future—when he estimated that the year 2200 would see an annual figure of 20 billion tons, or approximately four times the present consumption. If a third of the carbon dioxide by burning it all were to remain in the atmosphere, the carbon dioxide level would rise from 320 ppm today to about 365 ppm by the end of the century to about 1500 ppm over the next several centuries. It is for the scientists to decide on the global effects that will arise. Further, his projection shows the world's supply of fossil fuels would be exhausted by the year 2900 but does not take into account recent undersea discoveries.

In connection with sulphur which forms the subject of this afternoon's session, it is worth noting that Sweden has legislated for a national maximum sulphur content in oil of 2½ per cent, and of 1 per cent for the cities of Stockholm and Gothenburg, similar controls having already been introduced in Paris, central New York, Oslo and in the City of London. On a somewhat lighter note one can sometimes see from the river a plume of sulphur drifting from a power station towards the Houses of Parliament, and this may have some effect on the curious proceedings inside.

Prominent chest physicians have informed me that they do not want their patients to get a whiff of sulphur, and it has been estimated that roughly 60-70 per cent of the population are detrimentally susceptible to sulphur gases. The welcome arrival of natural gas and the extended use of nuclear power could substantially alleviate the pollution of urban areas but since the removal on a large scale of sulphur from fossil fuels is said to be not commercially practical, although there are interesting developments regarding coal, the projection I have mentioned presents a probable menace to the environment in which future generations will exist. As the Chief Alkali Inspector has said, we do not want Britain to be the dumping ground of high sulphur fuels, and it seems reasonable to adopt a national maximum sulphur content of 2½ per cent and a long ranging fuel policy in this country, which we now lack, appears vitally necessary as part of environmental conservation.

John Evelyn published his Fumifugium in 1661 and reprints of this are still available from the Society. In it Evelyn deplores, with indignation that the " Glorious and Ancient City of London should wrap her stately head in Clowds of Smoake and Sulphur, so full of Stink and Darknesse". I am glad to feel that I have had a steering hand in remedying both causes of Evelyn's just complaint, and were he alive today he would rejoice in what has been achieved not only in London, but in many other parts of the Kingdom, due in no small measure, to the hard work of many of our colleagues both present and past. There is, however, no room for complacency for as one problem is tackled another emerges both on the domestic and global issues for example, lead and carbon dioxide. This Society will continue to play its part but could do a great deal more were it not sadly hindered by its slender financial resources and income. If this situation can be improved, the Society has the ability and enthusiasm to tackle other questions relating to the environment and is organised to do so throughout the country.

I now turn to the large number of local authorities who have yet to comply with the national policy of domestic smoke control. These authorities have now no excuse whatever in delaying their proposals in view of the assurances that have been given that adequate supplies of solid smokeless fuels, as well as other suitable forms of heating, will fill their requirements. I would like to see every candidate standing for election to their Council in these laggard areas, asked if he, or she, will undertake to promote smoke control. The Beaver Report projected 1975 for the whole country to be smokeless, so we have four years only to hit the target. In this, the Divisions of the Society can continue to play an important part and I hope that grand body of men, the Association of Public Health Inspectors will bring what pressure they can on their colleagues in such areas. In a united effort we can make a great surge forward to make the Minister's mandatory powers unnecessary—a course, I am sure he would be reluctant to exercise—but which I hope he will do if necessary and which would reflect very poorly on the local authority concerned. Let these authorities be reminded, *inter alia*, that those of their residents suffering from respiratory diseases are in desperate need of early action.

In this connection, delegates may remember that Dr. Percy Stock's investigations in 1960 showed that the incidence of lung cancer was strongly correlated with smoke density in the north of England, and that cancer of the stomach and intestines were related significantly with smoke in the 30 County Boroughs which were investigated. How can any local authority continue to condemn its inhabitants to such a risk? Why is there such opposition and delay in applying smoke control to these areas when it could yield so many benefits and lessen illness, death and human misery, reduce medical

costs and absenteeism, increase productivity and significantly reduce the repair and renovation of buildings, and improve our fuel resources.

I mentioned the Divisions just now and one has only to read their reports in the Year Book to realise that this is where the field work is done on which so much of the success of the Society's efforts depends; and also to appreciate the splendid voluntary work of the officers of each Division, especially the Chairmen and Secretaries. I notice that one Division recommends that students in universities, colleges and schools be encouraged to participate in membership of the Society. This suggestion is in line with my remarks in Guildhall last June when such students were present at my invitation. I hope the Council will pursue this objective since it is these young people and the generations to come who will benefit from our labours and who should have an opportunity of making their own contribution. Perhaps we can form a special students section of membership, for this Society is, of course, the recognised national forum for the promotion of clean air.

Looking again at the Year Book one is struck once more by the large number of firms listed therein in the Trade Directory, and this indicates to some of us that all these people in this new industry should get together to form either a section of their own within this Society or to form their own trade association. It is here appropriate to refer to the remarkable progress towards clean air by industry generally in this country and reference to the Chief Alkali Inspector's annual report does underline the immense difficulties which have been overcome, involving substantial financial outlay. It is a great tribute to all concerned that such progress has been made, but it is evident when going round the country, that several problems still remain to be solved.

Although the subject of emissions from motor vehicles is not included in our deliberations this year having been discussed on previous occasions, it is uppermost in the minds of the general public when clean air is mentioned. The Society brought this problem before the late Ministry of Transport but nothing effective was done about motor cars until the Regulation in regard to the crank case emissions was issued earlier this year by the new Department of the Environment—several years indeed after France had taken similar action. Certainly welcome action has been taken in regard to diesels and although an improvement is noticeable, stronger efforts of enforcement are obviously necessary.

So far as the petrol-driven engine is concerned it will be extremely interesting to see the results of the research announcd in the U.S.A., to which our Government is making a substantial financial contribution. This is evidence that the authorities acknowledge that the public is not content to be the recipients, in whatever quantities, of poisonous and objectionable gases or fumes either in congested streets or in their home garages. It is now out of date to say that existing car exhaust emissions are within acceptable tolerances, since it is becoming increasingly evident that public opinion demands the highest possible quality of life, and is not content to accept things as they are. Let us not forget, however, that cigarette smokers incur greater risks from carbon monoxide than that generally found in the ambient air.

Since there is diverse evidence from reputable medical sources as to the slowing down of reflexes by drivers in congested areas due to carbon monoxide, surely one should come down on the side of caution? Delegates will have noticed that the Royal Commission forecasts a car population in Britain of 25 million by 1980 as compared with 16 million now. With the international demand for acceptably clean cars and aircraft a demand which must be met, I do believe it is time for motor and aircraft manufacturers to participate in our membership so that they can join in the discussion of our Technical Committee in order that their problems may be more readily understood, and concerted action taken if desired. Manufacturers in other industries have found this a worthwhile course, and whilst advancing their own point of view have made a valuable contribution to this Society's objectives. It is most regrettable that the United Kingdom is behind the European community in legislating against carbon monoxide and hydrocarbons. When the Society pressed the previous government to take action one of the excuses given for not doing so was that discussions were going on so that legislation here would coincide with that on the Continent. In the event, the Continent is well ahead of us, so far as legislation is concerned; but it is pleasing to know that certain motor manufacturers in this country are providing cars complying with E.C.E. standards or will be doing so in the near future. To be fair to all British motor manufacturers, my own and the Society's oft repeated request for mandatory legislation should be enacted.

Touching for the moment on the subject of local government reorganisation, it would appear to many of us that the application of legislation relating to the environment is likely to be best administered, subject to overall policy, by those close to local problems and it appears that it would be disadvantageous to disturb those men and women who have worked so hard and enthusiastically in the cause of clean air throughout the country.

Indeed it is because of this spirit among our members, because this Society has fought over so many years to provide happier and healthier living conditions for our people, because this country was the first to have clean air legislation, and because there are still many problems the solution to which this Society can make such a valuable contribution that I feel so honoured to occupy this Presidential Chair.

INTERDEPARTMENTAL COMMITTEE ON AIR POLLUTION RESEARCH

Report on Progress in Research on Air Pollution in the United Kingdom

The report is almost entirely concerned with research partly or wholly government-funded, i.e. it does not give a comprehensive report on research by industrial firms such as the oil companies. It refers to the situation as it was at the end of 1970.

It is arranged by subject in the same way as the list of air pollution research programmes in the U.K. published in the Clean Air Yearbook for 1971-2 and the numbers in brackets throughout the text refer to this list. Main subdivisions are:

Part 1: Abatement of Emissions of Pollutants.
Part 2: Dispersion and Distribution of Pollutants.
Part 3: Effects on Health.
Part 4: Effects on Animal Life, Vegetation and Materials.
Part 5: Measurement Methods.

The reports were provided by:
Part 1: P. E. Trott (W.S.L.) and Dr. W. H. Gutt (B.R.S.).
Part 2: C. F. Barrett and M.-L. P. M. Weatherley (W.S.L.).
Part 3: Professor P. J. Lawther (M.R.C.:A.P.U.).
Part 4: Dr. C. C. Webster (A.R.C.).
F. H. W. Green (N.E.R.C.).
E. G. Mallalieu (D.O.E.).
Part 5: Dr. D. Gall (W.S.L.).

Part 1: Abatement of Emissions of Pollutants

Sulphur compounds(1.1)

The removal of SO_2 from flue gases is still being investigated by CEGB; chemical work directed towards finding a satisfactory physical form of sodium aluminate or other absorbent for sulphur dioxide in flue gases is being continued.

Research by the NCB on a new method of burning coal in power stations, involving combustion of coal in a fluidised bed of ash, has now reached the stage of large-scale test. One of the outstanding advantages of this method is that sulphur in the combustion gases can readily and cheaply by removed in the ash by addition of limestone. The contribution this can make to clean air has aroused particular interest in the U.S.A. and the N.C.B. has signed an agreement for collaboration with N.A.P.C.A. who have instituted research on the application of the method in America.

Oxides of nitrogen (1.2)

The project on the formation of oxides of nitrogen in combustion systems at the Department of Fuel Technology of the University of Sheffield has now been completed and is being written up in the form of a Ph.D. thesis

Grit and dust (1.3)

The present activities of the C.E.G.B. in this field of abatement are principally concerned with bringing up to their optimum performance any remaining electrostatic precipitators which are still operating below this, and in establishing on every chimney monitoring devices to alert the operators to any falling-off in efficiency.

The B.I.S.R.A. Intergroup Laboratories of the British Steel Corporation and individual works laboratories are continuing their work on the reduction of grit and dust which arise in the course of iron and steel making processes.

An important development which could affect the achievement of both public and private sectors has been realised in the laboratories of the Steel Castings Research and Trade Association. Essentially this affects electric steelmaking. The process consists of injecting by a carrier gas (compressed air) a powdered metal oxide into a liquid steel bath to produce a carbon boil without the emission of brown fume which is associated with oxygen injection. Crushed mill-scale is very suitable because of its density and high content of iron oxide, but other powdered materials including ore fines can be used with equal success. Additionally, powders containing an oxide of a metal which is a constituent of the steel (e.g. Ni or Mo oxides) can also be used to achieve simultaneous alloying and refining.

The oxide injection process has satisfied the Alkali Inspectorate as a means of controlling fume emission during refining of steel' and has been patented. The commercial marketing and exploitation of this invention are being undertaken by the N.R.D.C.

Air pollution from combustion and industrial processes (1.4)

Studies have begun at I.C.S.T. (Department of Civil Engineering, Public Health Engineering Section) on industrial processes involving probable formation of carcinogenic or toxic materials, and on the mechanism of formation of aromatic polycyclic hydrocarbons involving a pyrolysis of polymeric materials formed in combustion processes; the work is expected to continue for 5 or 6 years.

Brickworks, heavy clay and ceramic industries (1.8)

Tests by W.S.L. on continuous kilns making fletton bricks have established at which stage in firing the pollutants are emitted. The fletton brickworks odour is now being studied in the laboratory. Time and temperature conditions necessary to remove it in a hot zone have been specified.

The outstanding problems under investigation by the B.CeramR.A. are connected with blue brick manufacture and alternatives to salt glazing. In both cases the use of liquefied petroleum gas and gas-firing is being considered. Other problems in the heavy clay industries are being overcome by further reduction in the small number of intermittent kilns still in existence, by increasing chimney heights and by changing from coal to other fuels. The emission of smoke from pottery kilns has been eliminated by changing from coal-fired bottle ovens to tunnel kilns or modern intermittent kilns fired by electricity, town gas, fuel oil or liquefied petroleum gas. (See also paper by W. H. Holmes and E. Rowden to Clean Air Conference, Oct. 1969).

Reduction in air pollution from salt glazing and blue brick manufacture has been under investigation by a working party consisting of representatives of the Alkali Inspectorate, the National Federation of Clay Industries and the B.CeramR.A. They have been assisted by research and development carried out by the N.C.B., oil companies and the Gas Council in co-operation with the working party.

(a) Salt Glazing—Smoke, grit and dust are not serious problems of this industry, because they would be detrimental to the product, although naturally the cleaner the fuel used, the cleaner the emission to air. Even the cleanest fuels would only eliminate a portion of the pollution because many pollutants, such as sulphur and fluorine compounds, are derived from the clay, and oxides of nitrogen are formed during fuel combustion. The major problem is the emission of heavy white fumes during the salting operation and this remains unaffected by the fuel used. The present trend, encouraged by the Alkali Inspectorate's requirements, is away from salt glazed pipe either to fully vitrified pipe or to ceramic glazed pipe.

(b) Blue Brick Manufacture—Experiments have been carried out at various works sites on the firing of blue ceramic ware with natural gas or liquefied petroleum gas on a production basis and a very promising measure of success has been achieved. The industry is now in a stage of developing this technique and time is required for individual firms to apply it to their own sites and production requirements, each of which has its own peculiarities and problems.

Coking plant (1.10)

The B.CokeR.A. is still investigating methods for reducing emissions from coking plant; a booklet has been published giving practical suggestions.* Instruction on measurement of grit and dust in chimneys is given regularly to improve monitoring of emissions.

(* Practical Suggestions for Reduction of Emissions of Smoke, Dust and Grit at Coke Ovens, Brit. Coke Res. Ass. Spec. Publ. No. 5, 1969).

Industrial plant, especially copper and aluminium works (1.11)

The B.N.F.M.R.A. has carried out investigations on efficiency of types of equipment for trapping metal fumes, and removal of oil from swarf to prevent evolution of black fumes during melting. More recently there has been work on lead emissions and on primary aluminium smelting.
(See also B.N.F.M.R.A. paper to Basle conference, Oct. 1969: "Air Pollution and Water Conservation in the Copper and Aluminium Industries").

Motor vehicles (1.12)

The effort devoted to the diesel engine programme by M.I.R.A. is smaller than that on petrol engines and is at present confined to assessing and improving smoke measurement methods. In particular it is providing information needed for a general specification for light obscuration smokemeters (opacimeters), required for draft E.C.E. regulations. It is proposed later to investigate the control of oxides of nitrogen.

The Government is concerned* with developing a method of using instruments to check smoke emission, that could form part of the existing sequence of operations for the annual check on maintenance of the vehicles in goods vehicle testing stations. At present smoke emissions are only checked visually.

(* See para. 27 of the White Paper on pollution: "The Protection of the Environment: the Fight against Pollution", London: H.M.S.O. Cmnd 4373, May 1970, presented to Parliament by the Secretary of State for Local Government and Regional Planning, the Secretary of State for Scotland, and the Secretary of State for Wales.)

Short-term work on petrol engines at M.I.R.A. is currently concerned with assessment of new test procedures proposed by the U.S. government for 1972 and later model year cars. These procedures include new methods of sampling the exhaust (variable dilution sampling) and a new driving cycle. Another project concerns the control of oxides of nitrogen by recirculation of exhaust. Help is also given to the industry in organising inter-laboratory analytical equipment cross check schemes and preparing up-to-date summaries of legislation. The long-term work is concerned with the effect of mixture quality and combustion chamber design on exhaust emissions; this is being done on a single cylinder engine and has included measurement of exhaust reactivity.

At W.S.L. the reduction of oxides of nitrogen by reaction with carbon monoxide over a catalyst is being studied by the Catalysis Section to determine the most effective catalyst for this purpose.

Aircraft (1.13)

Investigations are continuing at the N.G.T.E. on the production and consumption of pollutants from rich hydrocarbon/air flames at high pressures with particular reference to gas turbine conditions.

Domestic smoke (1.14)

A major part of the N.C.B's research programme on coal utilisation has always been devoted to the development of new types of domestic smokeless fuels. In the past few years, an alternative approach to smoke control in the domestic field has been research on appliances so designed that they can burn ordinary coal without production of smoke. Both of these lines of research have led to commercial development.

Asbestos (1.16)

In recent years a proportion of the Building Research Station's research effort, particularly in the Materials Division, has been directed to the development of fibre reinforced composite materials for building. A potential result of this work, although it was not a primary objective, is a considerable reduction in the use of asbestos fibre, and therefore of the associated hazards to health.

The first material developed, glass fibre reinforced gypsum (G.R.G.), could economically replace asbestos board in many of its uses for fire protection such as fire check doors or partitioning in buildings or shops. G.R.G. is restricted to internal use. Manufacture of G.R.G. components is under active consideration by industry.

For external use, another composite material, glass fibre reinforced cement (grc) based on a special alkali-resistant glass fibre has been developed at the Station but is not yet in commercial production. If the development work is successful, future production of the fibre could considerably reduce present use of asbestos fibre in the manufacture of asbestos cement products.

Part 2: Dispersion and Distribution of Pollutants

Study of dispersion of chimney gases (2.1)

The study of dispersion of pollution from a very large single source (Eggborough power station) is being undertaken by the C.E.G.B. Measurements of plume rise and geometry at distances up to 3 km are being made by means of lidar equipment and ground level concentrations are being measured by a network of continuous SO_2 recorders at distances up to 15 km.

The pollution from clusters of chimneys is being studied by Esso Research, and by Shell Research in Amsterdam. Measurements of ground level concentrations are compared with the predictions of computer models.

An extensive programme of research and development is being carried out by the Gas Council into low level domestic flues.

Model tests in wind tunnels have been conducted for many years at the N.P.L. Aerodynamics Division and are continuing; these are ad hoc tests for repayment. The demand shows no signs of diminishing. Research is being conducted by the C.E.G.B. both in their own tunnels at Leatherhead and Marchwood and under contract at Bristol University to improve methods of simulating atmospheric wind and turbulence profiles for use in studying the aerodynamic behaviour of individual buildings and of complete sites of power stations. The work may be extended to include thermal effects. W.S.L. has recently commissioned a wind tunnel with facilities for introducing wind shear and turbulence both for ad hoc testing for repayment and for research.

British Hydromechanics Research Association are carrying out laboratory tests on the feasibility of using vortex rings to obtain very large rise for pollution and allow the use of low chimneys. The work is under contract to the N.R.D.C.

Studies of dispersion and of meteorological factors in the lowest kilometre of the atmosphere (2.2)

W.S.L.'s programme on diffusion in towns using tracers is now completed and written up (see "An experimental study by means of a fluorescent tracer of diffusion in two urban areas", by C. F. Barrett, W.S.L. L.R. 117(A.P.)).

W.S.L. is conducting studies of the distribution and dispersion of particulate matter in the air over cities by light scattering methods using a lidar.

The Meteorological Office is continuing the study of the lowest kilometre of the atmosphere using instruments on masts or tethered balloons. Turbulence as well as temperature, wind and humidity structure are being studied and these provide (among other things) background information relevant to the dispersion of pollution.

Background information is also provided by model studies in a water tank conducted at the Loughborough University of Technology on the penetration of inversions by thermals and plumes.

Studies of dispersion and of the influence of meteorological factors (2.3)

The system developed some ten years ago within the Meteorological Office for the estimation of concentration of smoke and other pollutants from a specified source, under a wide range of weather conditions, is under present review in order to include more recent theoretical and experiemental findings. Amongst these has been an analytical and theoretical study carried out within the Office of dispersion in urban areas.

Studies of dispersion on global scale (2.4)

B.P. has recently measured SO_2 concentrations at low levels in a voyage between U.K. and Sweden to assess the drift of that pollutant; this study is in course of publication.

The A.E.R.E. has a continuing programme of monitoring radioactivity including fission products and obtains information on global scale dispersion.

The Meteorological Office has been studying the theoretical dispersal of material in the free atmosphere by employing calculated winds derived for real times up to 72 hours from methods of numerical weather prediction. Over even longer time scales of dispersion the present Office programme for the study of the world-wide atmospheric circulation will, it is hoped, provide further understanding of the global distribution of pollutants.

Studies of drift on continental or smaller scale (2 .5 and 2.9)

Measurements of smoke and SO_2 are made in country districts as part of the National Survey. In addition W.S.L., as part of an investigation on drift on a continental scale, is investigating pollution at background sites and has installed directional samplers at coastal sites, one on the east coast at Happisburgh, and one on the west coast of Ireland, to provide some indication of ground level pollution entering and leaving the U.K. and Ireland from the North Sea and Atlantic Ocean during the winter heating period. O.E.C.D. is trying to organise a European-wide investigation on drift and decay of sulphur dioxide, both near ground level and up to several thousand feet up. It is hoped that the U.K. side of this will be cooperative effort between the Institute of Petroleum, C.E.G.B., A.E.R.E., and W.S.L.

Aerobiology in relation to forest disease development (dispersal of fungus spores) is being investigated (N.E.R.C./Oxford University).

A study is under way in the Dept. of Biology, Portsmouth College of Technology on the effects of forests stands on drifting polluted air. The preliminary study will end within a few months and plans for further work will depend on evaluation of the data obtained.

Distribution of pollutants throughout Great Britain (2.6)

The National Survey of smoke and SO_2 has now been under way since 1961–2, although records for many sites go back very much further. It was originally intended that it should run for a period of about five years, on the grounds that this period would cover a sufficient range of weather conditions to enable a proper assessment to be made. Its primary objects were to enable the M.H.L.G. to assess progress being made under the Clean Air Act of 1956 and to pinpoint the areas where effort was most needed; it was also recognised that the data would be of great use to researchers on the effects of air pollution on human health or on other aspects of air pollution.

Periodic assessments have been made over the years, using the data, of trends in concentrations, and general levels of pollution in different parts of the country. Some eighteen months ago it was recognised that there were now sufficient data for definitive analyses to be made, after which decisions would have to be taken as to the future of the survey and the streamlining of the effort involved. It was decided that the data would be analysed region by region in relation to the geographical factors such as topography, population density, industry, to see what conclusions could be drawn and what recommendations made regarding smoke and SO_2 for each region. The reports will be published as they are completed; the first (for the south east and north west regions and for Greater London) will be published at the beginning of 1972. The Local Authorities involved are given the opportunity to criticise the reports in their draft stage, in the light of their special knowledge of their districts.

It is envisaged that a streamlined smoke/SO_2 survey will still be necessary for some years to come.

Distribution of pollution in urban areas (2.7)

Work is continuing in Sheffield in the Department of Geography, namely:

1 analysis of the data acquired in past years in the course of the Sheffield University/W.S.L. survey, e.g., effect of smoke control, and to gain a better understanding of the association between weather factors, including humidity, and pollution;

2 practical investigations of particular phenomena such as the incidences of high SO_2 concentrations in the Don valley.

(For the most recent published report on this survey see "Some Climatological Problems in Urban Geography with reference to Air Pollution" by A. Garnett, Inst. Brit. Geographers, Trans. & Paps., Publ. No. 42, 21–43, (1967)).

The Sheffield survey is throwing light on particular conditions in an inland city with very distinctive topographical and industrial problems, governed by a council very active in the field of clean air and urban renewal. Edinburgh also has distinctive but very different geographical features and its pollution has also been surveyed for some years by workers in the Geography Department who are in the final stages of collating the information on SO_2 emission for what is probably the most detailed emission study ever made in the U.K. SO_2 emissions by industry have been mapped for Sheffield, and a detailed inventory was made for all fixed sources in Reading by the B.P. team which carried out a survey in that town, but in general surveys have tended to relate to concentrations of pollution near the ground rather than amount and distribution of emissions, which has made drawing of any very precise conclusions as to relative effects of topography, etc., on pollution rather difficult.

Some work has also been done in Edinburgh on distribution of pollutants and temperature round the volcanic hill called Arthur's Seat on the eastern edge of the city. A survey of the cost of cleaning air pollution from Edinburgh's buildings has shown that for the central area alone the cost has been more than £250,000.

In the case of London, the analysis of the National Survey data has shown that following the marked decrease in emissions of smoke from chimneys the high density residential districts no longer suffer more smoke than the central zone; the dirtiest sites tend to be on or near busy roads in the central zone or in commercial districts in high density residential areas. London's administrative and commercial centre suffers the highest average concentrations of SO_2 measured in the U.K. and the decrease in concentration found elsewhere in London is not noticeable in the centre.

Measurements of temperature and SO_2 are still in progress on three levels of the London P.O. Tower (investigation involving collaboration between W.S.L., the Geography Department of University College, and the P.O. research engineers) although because of instrumental and other difficulties the periods for which both temperature and pollution records are available are limited. It is hoped that this study will throw some light on the mechanism of accumulation and disperson of pollution in London.

The G.L.C. continues to hold a watching brief on pollution in London, besides contributing data to the National Survey. Much of its work in the field consists of ad hoc investigations of particular problems rather than formal surveys.

"The Bearing of the Urban Temperature Field upon Urban Pollution Patterns", by Professor T. J. Chandler (Atm. Environment, 2, (6), 619-20, (1968)) reports on this work at University College, London. A paper on the College's work on trend surface analysis has also been published in the same journal in 1970 (author Mrs. P. Anderson); this technique was applied to analysis of National Survey data over a particular region of the country.

Work on meteorological aspects of air pollution carried out at Reading University has been written up as a Ph.D. thesis, available from the University library: "Micrometeorological Measurements at Rural and Urban Sites, with Application to Air Pollution Problems", by M. N. Hough, 1969.

As regards pollution in streets, surveys of CO and diesel smoke have been carried out in 260 representative streets in London, Canterbury and Edinburgh as part of a wider survey (by I.C.S.T.) also involving factors such as vibration and noise. The data are in process of statistical analysis. W.S.L's survey of CO in six towns, conducted for the Ministry of Transport, has been completed and a report is being published. W.S.L. is also investigating (at M.O.T. request) whether the CO inside cars is higher than the ambient condition, especially in congested traffic. In addition W.S.L. is investigating the extent to which the CO inside a car is affected by defects in the vehicle's own exhaust system.

A paper based on the work at I.C.S.T., in the Department of Chemical Engineering, on pulses of SO_2 and atmospheric turbulence has been submitted for publication.

Air pollution in relation to climate (2.8)

The effect of air pollution on the income of short wave radiation at the surface and on the radiation balance is being investigated at Nottingham University, School of Agriculture, Dept. of Physiology and Environmental Studies. Observations on cloudless days have shown that attenuation of the direct component of solar radiation is approximately proportional to air mass (the path length of the solar beam) but there is a significant diurnal variation. On some days the atmosphere gets "dirtier" as the day progresses and on others it gets "cleaner". This may be a consequence of a change of dust content between different air masses or of the combination of the two processes which change diurnally in opposite directions.

A subsidiary project has established a relation between direct radiation, hours of sunshine and smoke concentration which will be used to show what national levels of smoke concentration mean in terms of loss of solar energy.

The work of the A.E.R.E. on visibility and pollution is reported below. (See also "The Chemical Composition of Atmospheric Aerosols on Tees-side and its Relation to Visibility", by A. E. J. Eggleton, Atmospheric Environment, 3, 337, 1969).

Work is continuing on air pollution and climate in Teesside and County Durham (University of Durham, Department of Geography).

The White Paper* on pollution mentions the current discussion of the possible conflicting effects on the earth's temperature of the increase of CO_2 in the atmosphere on the one hand and the increase of dust in the upper atmosphere and vapour trails from high flying aircraft on the other, and states that the Government has asked the Royal Commission on pollution of the environment to comment on the adequacy of the research in this field and intends to play an active part in international organisations considering these matters.

(* The Protection of the Environment: the Fight against Pollution, London: H.M.S.O., Cmnd. 4373, May 1970, presented to Parliament by the Secretary of State for Local Government and Regional Planning, the Secretary of State for Scotland, and the Secretary of State for Wales).

Atmospheric chemistry (2.8)

The work of the A.E.R.E. on Teesside mist and atmospheric chemistry is continuing:

a Automatic equipment has been designed for the short-term sampling of pollutants on Teesside and elsewhere and for the simultaneous recording of relevant meteorological data. The following items of equipment are included:

1 an automatic high flow-rate sampler for collecting hourly samples of aerosols on paper tape;
2 impregnated paper tape samplers, specific for sulphur dioxide and ammonia;
3 an integrating nephelometer for measuring visibility by a light-scattering technique;
4 an atmospheric stability indicator, based on the measurement of radon daughter products in the atmosphere;
5 a data logging system, based on the Harwell 7000 series.

Two automatic stations were successfully operated on Teesside in the latter half of 1969. Three have been installed for further studies on Teesside in 1970 and a fourth reference station has been erected on the airfield at Harwell.

b Laboratory studies are being carried out on the following topics:

1 the oxidation of sulphur dioxide to sulphuric acid and ammonium sulphate;
2 the uptake of sulphur dioxide on surfaces;
3 the life-cycle of sulphur dioxide in the atmosphere.

The Dept. of Fuel Technology, University of Sheffield, has been awarded a grant by the S.R.C. for studying the stability of aerosols and fog formation in the presence of pollutants such as oxides of sulphur and oxides of nitrogen.

Bactericidal properties of pollutants (2.11)

For recent publications on the work of the M.R.E. on this subject see "The Open Air Factor", by H. A. Druett and K. R. May, New Scientist, p. 579, (13th March 1969), and "Toxicity of Open Air to a Variety of Micro-organisms", by H. A. Druett, K. R. May and L. P. Packman, Nature, 221, (1586), 1146, 22nd March 1969.

Part 3: Effects on Health

No attempt is made in this section to list the topics on which promising research is being done; it is intended rather to give some indication of the direction in which work on air pollution in relation to health is tending to move in this and in other countries.

Acute effects of pollution

Following the demonstration that excess deaths were associated with the increase in pollution seen in "smogs" strenuous efforts were made to identify the pollutant or combination of pollutants which were responsible for the mortality so that their emission could be prohibited or means of protection devised. Sulphur dioxide and sulphuric acid were widely held to be the most likely culprits largely because they were known to be irritant in relatively high concentration; the clinical picture so far as it has been observed was consistent with the inhalation of an irritant gas or aerosol. Thousands of experiments using sulphur dioxide on animals and on normal human volunteers have failed to demonstrate that this gas alone in the concentrations likely to be encountered in polluted town air could be held responsible for the effects seen. Experimental work on animals demonstrated a synergistic effect between sulphur dioxide and salt particles but attempts to reproduce this effect in humans have been unconvincing. Similarly much careful work on the possible effects of sulphuric acid mists in realistic concentrations has been of little help. There remains the distinct possibility that the methods by which small changes in airway resistance have been sought have been too crude and that hitherto undetected increases in resistance to pulmonary air flow, without any effect on normal subjects, may yet be intolerable in patients with damaged cardio-respiratory systems. The results of experimental work and more especially

of some epidemiological research tend to incriminate smoke rather than sulphur oxides. The development of new techniques especially to determine ventilation perfusion ratios in non-homogenous lungs is a fruitful field of investigation. These techniques might be applied to patients during exposure to "naturally" occurring pollution thereby overcoming the self-imposed limitation of confining experimental exposures, however small, to normal adults. The analysis by computer of resting respiratory flow patterns would seem to offer hope of solution of the identification of broncho constricting substances.

The epidemiological approach to the problem of identifying the active pollutants is complementary to the use of the experimental method and may indeed be more successful. The studies of the variations in mortality and morbidity in relation to daily changes in pollution have been invaluable and have enabled us to display the way in which, as pollution especially by coal smoke has diminished, associated changes in mortality and inclines have all but disappeared. In a recent study there appears to be no correlation at all between sickness and concentration of sulphur dioxide though there is a degree of correlation with "total suspended matter". It is essential to the proper interpretation of data obtained from studies of mortality and morbidity to study only variations seen over long periods and to take due account of other major influences such as weather and infection.

Chronic effects of pollution

Exposure to lower grades of pollution than those found in "smogs" is likely to be one of the factors in the development of chronic bronchitis. The idea that changes in the bronchial tree could be brought about by chronic exposure to the low concentrations of sulphur dioxide found ordinarily in town air is untenable. Again, methods of investigation are experimental and epidemiological.

The discovery of a factor, or factors, present in coal smoke, which appears to stimulate in vitro the growth of Haemophilus influenzae (an organism commonly found in the sputum of patients with chronic bronchitis) may be important if this effect can be shown to facilitate infection of the lungs. Similar effects of pollutants on viruses are being sought. There is some good evidence from work in the U.S.A. that oxides of nitrogen, in the parts per million range, may favour the development of infection of the lung and in some instances may mimic, in experimental animals, the pathological picture seen in human emphysema. The part played by immunological responses in this work is important and merits continuing attention.

Throughout this work, and indeed throughout the epidemiological studies mentioned below, the overwhelming effect of cigarette smoking is apparent. Among the epidemiological techniques which show great promise is the study of large groups of children from birth, and other "cohorts"; there is good evidence of a close relationship between the prevalence of lower respiratory tract infection and pollution in the first year of life and this relationship is seen to persist through adolescence. Follow-up studies of young adults (studied previously as children) are in progress. Studies of mortality and morbidity from chronic bronchitis are already demonstrating convincingly that the decrease in pollution over recent years has been beneficial.

The part played by air pollution in the genesis of lung cancer must be very small in relation to that of cigarette smoking. Despite this, studies of likely carcinogens in urban air continue, though with less enthusiam and conviction than formerly. Again, the work is both in the experimental and epidemiological fields; in the latter, the study of cohorts has again been fruitful.

Special problems

Research on the extent and effects of pollution from motor vehicles continues to occupy much time and energy. Most workers in the field recognise the essential differences between the problems in California and in Europe and the need for careful and separate assessment. Since photochemical "smog" is unlikely to be more than a rare and transitory nuisance in Britain, work here has been concentrated mostly on the distribution and effects of carbon monoxide. Extensive measurements of CO in air have been replaced by surveys of CO in blood of people exposed to traffic. Rather unexpectedly, levels of CO haemoglobin in exposed non-smokers have been found to be much lower than was once assumed; cigarette smoking commonly produced carboxy-haemoglobin concentration considerably higher than those attributable to breathing street air. Sensitive modern methods of test have failed to reveal significant impairment of vigilance or performance following the experimental inhalations resulting in 5% saturation of haemoglobin by CO and a suggestion that some other factor in street air impairs vigilance has not yet been substantiated; work on this topic continues.

Analysis of street air has recently shown that nitric oxide is present in greater concentrations than nitrogen dioxide and the significance of this pollutant needs to be explored further.

In the past, the "blunderbuss" investigation of the distribution of "trace elements" has been regarded by many as the refuge of those bereft of hypotheses but there may be merit in the search for correlations between disease and the rarer pollutants despite the lack of appeal which this form of investigation has for the more orthodox worker.

That disease in the community may be caused by minute amounts of pollutant is well established by investigation of illness due to the inhalation of beryllium and asbestos. The latter group of minerals has received much attention recently because of the widespread use of asbestos and the recognition of the fact that minute amounts of crocidolite can cause mesothelioma of the pleura and peritoneum. The search for air-borne asbestos in the ambient air is fraught with technical difficulties but these are being overcome.

There is discernible throughout the published and current unpublished work known to us, a refreshing awareness that the problems of the effects of pollution on man are complex; the need for the humble approach is being recognised more widely. Obviously some general theory of toxicity would be welcome so that one may see in advance dangers from new pollutants which, in a society of growing complexity, will be produced even as the "classic" pollutants are abated. Fortunately there is no evidence of complacency in medical research in this field.

Part 4: Effects on Animal life, Vegetation and Materials
Animal life (4.1)—no report.

Vegetation (4.2)

Lichens and bryophytes†* (4.2a)
The work in the Dept of Botany, Newcastle University on the use of lichens and bryophytes as indicators of urban and industrial pollution has now been terminated. Observations have shown that despite wide differences in botanical affinity bryophytes and lichens are outstandingly similar in their response to SO_2, suggesting that these plants can only colonise inhospitable habitats by adaptations which carry with them an inherent susceptibility to air pollution. Observations have established correlations between the distribution and specific composition of the lichen and bryophyte populations and SO_2 levels in areas where the latter were measured instrumentally. The research worker involved is now at Sheffield University, Department of Landscape Architecture, and is doing some work on the effect of fluorides on lichens and bryophytes; specifically he is carrying out investigations in brickfield areas near Peterborough and in Bedfordshire, and near aluminium smelters at Fort William and Invergordon on effects of air pollutants, especially fluorine, on higher plants.‡

Detailed maps of distribution and height above ground of selected species are being constructed for south east England at King's College, University of London, (Geography Department). (See also "Qualitative Scale for Estimating Sulphur Dioxide Air Pollution in England and Wales using Epiphytic Lichens" by D. L. Hawksworth and F. Rose, Nature, **227**, 145–148, 1970).

An investigation is also being carried out, on a modest scale, on the effect of air pollution near Port Talbot, South Wales, on lichens and other plant groups, at the Dept of Applied Biology, Bromley College of Technology. This work initially formed part of a survey undertaken by the Dept of Social and Occupational Medicine, Welsh National School of Medicine, Cardiff into the incidence of bronchitis in steel workers in Port Talbot (3.2(b)). The current investigation involves study of the accumulation of pollutants by plants collected at various distances from the steelworks, and the effects of pollutants on various lichen activities and on community structure.

Other projects include:

i a short term project on effect of SO_2 pollution on the metabolism of lichens, in the Dept of Agricultural Sciences, Oxford University;

ii a project on effect of air pollution on epiphytic§ bryophytes at London University, Queen Mary College;

iii a survey of the effects of air pollution on the epiphytic bryophytes and bark of oak trees involving London University, University College and Oxford University, Genetics Laboratory, Dept of Zoology. Effort is dependant on availability of funds; a Royal Society grant was applied for in 1970. Measurements are made of the effects of air pollution in terms of (a) epiphyte cover of bark at 1.5 m height divided into percentage cover of different types; (b) number of bryophyte species present on boles; (c) maximum height at which byrophytes occur; (d) percentage reflectance of light of bark/epiphytes at 1.5 m. To date, ten trees have been investigated at each of 130 sites in England and Wales. The immediate aim to is compare the records with the local frequencies of the genetically determined industrial melanic forms of ladybirds and moths, but it is hoped that the results will have wider significance.

* lichens—a group of composite plants, consisting of an alga and a fungus in intimate association, and found on stones and trees.
† bryophytes—the mosses and liverworts.
‡ higher plants—plants having roots, stems and leaves and containing a vein system.
§ epiphytic—attached to another plant but taking no material from this plant.

Uptake of SO_2 by vegetation (4.2b)
Work at the A.E.R.E. has shown that the uptake of SO_2 by barley leaves is controlled by the humidity and light intensity as they affect the physiological state of the leaf. With good illumination and at high humidity the uptake is rapid, and in these conditions deposition on vegetation is likely to be important in respect of the fate of SO_2 released to the atmosphere. Comparison of the results on uptake of SO_2 expressed as diffusive resistance, with the results obtained by other workers on transpiration, show that the controlling factor on uptake by leaves is probably the degree of stomatal opening.

This work on SO_2 uptake by vegetation has now been completed. Consideration is being given to work on fluorine involving studies of levels in air at Husborne Crawley and rate of deposition under varying meteorological conditions, and experiments on the mechanism of entry of fluorine into plants.

There is a private project on the effects of SO_2 on fungi, at the National Institute of Agricultural Botany. Most phytopathogenic* fungi are susceptible to SO_2 in varying degree, the mode of action being essentially the same as a conventional sulphur fungicide. The toxicity of SO_2 in solution is governed by the pH of the solution and this leads to complications where the pH of water on the leaf is buffered or adjusted by other substances; it is hoped to investigate this further.

Response of stomata to air pollution (4.2c)
Work at the University of Lancaster, Biology Dept: SO_2 in concentrations similar to those often experienced in industrial areas (1.0 ppm) markedly stimulated stomatal opening, resulting in increased transpiration rate which could be serious for a plant with limited water supply. The use of an anti-transpirant (phenyl mercuric acetate), as a possible means of protecting plants against pollution, showed that it suppressed stomatal opening by day but stimulated it at night, and would thus increase SO_2 entry at night when it often accumulates in highest concentrations in the atmosphere. The original objective, to study interactions between SO_2 and CO_2 in polluted air, has not yet been pursued.

* phytopathogenic—causing plant disease.

Effect on air pollution on soils and vegetation (4.2d)

The effect of lead pollution from the atmosphere on plants and soils is being investigated at the Macaulay Institute, Aberdeen. The project will continue indefinitely and is a continuation of investigations started in 1963 on the contamination of vegetation near main roads with lead derived from motor vehicle exhausts. It now includes studies of contamination in areas remote from sources of pollution where the lead content of pasture herbage has been observed to rise markedly in autumn and winter. Preliminary findings suggest that the effect of deposition of lead from the atmosphere on lead in or on the above ground portions of plant arises directly from surface contamination and not as a result of uptake of such lead from the soil through the roots. Work in 1970 was designed to establish whether any additional lead enters the root and is held there.

Growth of trees in Pennines in relation to air pollution (4.2f)

Recent assessments (by the F.C.) in trial plantations have not elucidated the part played by SO_2 in unsatisfactory tree growth. Trees planted in the 1950's seem to have suffered more from exposure than from pollution and those planted in sheltered sites with high SO_2 levels (as assessed by lead dioxide gauges) have shown reasonable growth of some species. There has been a marked increase in the vigour of several experimental areas in the last 3 or 4 years but it is not known whether this is due to an evident reduction in soot deposition, to lower levels of SO_2 (although local records suggest that any such reduction is minimal) or to increasing resistance of the trees with age. Early growth of Punis nigra, planted in fertile, sheltered sites in 1966, has been satisfactory.

The F.C. is also investigating tree growth around the new aluminium smelter and oil refinery at Invergordon. This will involve assessment of pollutant levels in tree foliage before and after the start of industrial operations. Stratified sampling within a range of ten miles takes into consideration the following variables: distance, direction, exposure, crop age, crop vigour, canopy position of individual trees. The first "clean air" sampling has been completed.

Effect of a nearby major source of pollution on deciduous woodland (4,2h)

(University of Wales, Cardiff Institute of Science and Technology, Dept of Applied Biology). Sampling near a smokeless fuel plant has indicated a very definite gradient of stomatal blockage of oak leaves and there is also evidence of changes in the structure of the cuticle* and palisade† layer of the leaves. The functional significance of such change has not yet been assessed. An acceptable method has been devised for determination of atmospheric SO_2 concentrations in the presence of other pollutants, and the amount of particulate matter on leaf surfaces is being determined.

* cuticle layer (of leaves)—the outer layer.
† palisade layer (of leaves)—an underlying layer concerned with photosynthesis.

Husbandry practices to alleviate effects of air pollution: field studies (4.2j)

(N.A.A.S., Great House Experimental Farm). It has not been possible fully to evaluate the effect of SO_2 on plant life because of the absence of controls and the effects of other factors, such as climate, altitude and soil fertility, which cannot be segregated. Differences in susceptibility to SO_2 have been observed between species and varieties of grasses and clovers commonly used for the establishment of pastures, differences between varieties being greater than those between species. Indigenous strains of some species that have been naturally selected for resistance to SO_2 are rarely affected whereas plants of the same species raised from purchased seed failed to survive. A highly productive and SO_2-resistant indigenous strain of perennial rye grass has been selected.

Effect of air pollution on plant growth in glasshouses (4.2k)

(N.A.A.S., Lea Valley Experimental Horticulture Station). Mean daily SO_2 concentrations have not risen above 0.5 ppm since 1964 and, although higher levels may have been present for short periods, no signs of SO_2 damage have been observed on any crop. Trials of a wide range of materials for cleaning or protecting glass from deposited matter have not revealed any very satisfactory material other than hydrofluoric acid, which is dangerous to use on an extensive scale.

Effect of hydrocarbons on higher plants (4.2n)

All aspects of effects of hydrocarbons (mainly liquid but also gaseous) on plants being investigated as a long term project at the B.P. Research Centre. The study is expected to continue for at least a further five years and involves four research officers.

Materials (4.3)

Uptake of SO_2 by building materials (4.3a)

(A.E.R.E.). The investigations which are secondary to the main project—the determination of the levels of SO_2 which upset a plant's normal metabolism—have been continued and measurements have been made of the absorption of SO_2 by various materials including limestone, aluminium, wood, leather, wallpapers and some fabrics.

(I.C.S.T.). A paper based on the College's work in the Department of Chemical Engineering on absorption of SO_2 by stone in cities is being published in Atmospheric Environment.

Effect of air pollution as a factor in the durability of building materials (4.3b)

(B.R.S.). Work continues; nothing further to report.

Effect of air pollution on high voltage (25 kV) *insulators* (4.3c)

(B.R.: Electric Research Division). Present research is aimed at correlating (a) tracking and discharge activity and (b) discharge activity and atmospheric pollution on high voltage (25 kV) insulators. Experiments are in progress to obtain both laboratory and field experience and in the latter case the tests are arranged so that the effects of diesel exhausts can be isolated from those of general urban pollution. Recordings are made of discharge activity above certain pre-set levels and assessed in relation to deposition, smoke, SO_2 concentration, rainfall and rate of rainfall. The current programme is expected to be completed in two years.

Effect of climate and air pollution on corrosion of steel (4.3d)
(B.I.S.R.A.). The interest of the Association in the effect of air pollution on the corrosion of steel and zinc is a continuing one with occasional specific projects. Currently the Association is attempting to measure the corrosion resistance of low-alloy "Weathering" steels to find grades of stainless steel which are more resistant to pitting corrosion. They are developing the "Nash" type SO_2 recorder in consultation with W.S.L.

Effect of weather and air pollution on life of paint films; effect of light on paint degradation (4.3e)
(The Research Association of British Paint, Colour and Varnish Manufacturers). This Association which in the past has carried out several studies of the effects of air pollution on paint films, has little work of this nature in its present programme, but it has completed a study for the Ministry of Defence (Navy) of the effects of solar radiation principally near the ultra violet waveband on degradation effects of long oil alkyd paints. The objective was to compare the effects of radiation in the wavebands 300-350 nm and 350-400 nm as a basis for choosing the best radiation source for acceleration of the effects of solar radiation in the laboratory. This work is now being extended to a wider range of resins, including siliconised polyesters, and is already showing large differences in the relative sensitivity to different wavelengths, indicating the need for a close match to the solar spectrum in artificial weathering tests.

Effect of air pollution, weather, light on degradation of titanium dioxide pigments in various media (4.3f)
(British Titan Products). Effort in this field has been concentrated more particularly on the effects of weather and light so that they have no significant contribution to make to any work or study of the effects of air pollution. At present they do not envisage any particular project in this field.

Effect on Post Office equipment (4.3g)
Because of its interest in corrosion of equipment the Materials Section of the P.O's Purchasing and Supply Dept. is co-operating with W.S.L. in measuring vertical distribution of air pollution (SO_2) at the London P.O. Tower (mentioned under Part 2 of this report) and has installed pollution measuring instruments in its tower in Birmingham.

Part 5: Measurement Methods
Research on the measurement of air pollutants at Government establishments and Universities etc. has covered a wide range of topics related to particulate and gaseous pollutants in ambient air and in industrial atmospheres and effluents.

A critical study (M.R.C.:A.P.U.) of standard methods of analysis has recommended procedures for determining sulphur dioxide, sulphuric acid and carbon monoxide in ambient air and the measurement of nitrogen dioxide is under review. Methods recently developed and published (L.G.C.) for pollutants in factory atmospheres have included procedures for hydrogen fluoride, total inorganic fluoride, ammonia, ketones, aromatic amines and isocyanates and metal fumes.

More detailed interest is being taken in the collection and in the constituents of airborne particulate material. The design of the directional dust gauge (C.E.R.L.) has been modified and it is now commercially available: increasing experience has confirmed the value of the directional effect. A personal sampler designed (S.M.R.E.) to measure respirable dust in mine air is also being manufactured commercially. A study on the aerodynamical parameters of fibrous dusts may lead to a specification for an instrument for the collection of fibrous dust in a way which is biologically appropriate (M.R.C.:P.R.U.).

Other new instruments on trial (M.R.C:A.P.U.) include a high volume sampler using a filter of very fine glass fibres and a cascade impactor in which examination of the finer particles collected is facilitated by spreading them over a larger area by imparting a reciprocating motion to the collecting plates. A nephelometer, based on measurement of light scattered by a parcel of air from a flash tube fired every 10 seconds and stabilized against variations in the optical system, the flash intensity and detector sensitivity, has been developed (A.E.R.E.) to measure meteorological range (visibility). Light detection and ranging equipment incorporating a ruby laser is in operational use (W.S.L.) to measure the distribution of atmospheric aerosol over urban areas and study the diffusion and transport of pollution.

Development and manufacture of an instrument for monitoring dust in flues and chimneys has been consolidated (C.E.R.L.) and two firms in Great Britain are marketing the device: field trials at power stations have confirmed its operability and reliability. A smoke recorder for the measurement of smoke and fine dust in chimney gases has been developed to the commercial stage.

Atomic absorption spectrophotometry is being applied to the analysis of individual metals in smoke samples collected as part of the National Survey of Smoke and Sulphur Dioxide (B.C.T.D.:W.S.L.). A metal film technique measuring size and acidity is being used successfully (I.C.S.T.) for acid particles in the air but the use of silver membrane filters for the collection of airborne fluoride (W.S.L.) has proved impracticable. Work has started (I.C.S.T.: Public Health Engineering section of the Civil Engineering Department) on the analysis of aromatic polycyclic hydrocarbons in airborne particulates, soots and oils using gas chromatography and mass spectrometry, on analysis of lead tetramethyl and tetraethyl in the presence of less volatile lead compounds, and on analysis of trace metal pollutants by the formation of volatile metal complexes.

The rate of the heterogeneous surface reaction between gas and solute has been found (M.R.E.) all important in the design of high efficiency sampling equipment for collecting gases: the study has suggested a new sampling medium for nitrogen dioxide. Automatic samplers using impregnated paper tape combined with a Technicon analyser have proved suitable for hourly determination of sulphur dioxide and ammonia: data are recorded on punched paper tape (A.E.R.E.) A British firm has undertaken commercial production of two versions of a sulphur dioxide monitor operating on conductivity measurement (W.S.L.). An oxygen meter based on a metallized membrane polarographic cell has been developed (S.M.R.E.): the detecting system can be adapted to a personal monitor on to a recording or warning system. The possibility of designing equipment to discriminate between different types of petroleum fuel products is being investigated (N.G.T.E.).

Flame photometry has proved a suitable technique in field tests for the estimation of odorous sulphur compounds in air: subjective measurements are made for comparison (I.C.S.T.). Concentrations of radon, which provide a guide to atmospheric stability, are being determined over hourly periods by radioactive assay of the particulate daughter products collected on a filter (A.E.R.E.) The micro-thread technique (M.R.E.) by which bacteria can be exposed to polluted air to assess damage caused by the toxic "open-air factor" is now a well established laboratory and field tool and should prove of value in identifying the presence in air of constituents carrying a biological hazard.

There has been a general trend towards increased use of automatic instruments for the analysis of pollutants and for sampling. A directional sampling device (W.S.L.) which controls air sampling in accordance with pre-selected directions and speed of wind is now available commercially. Greater use is also being made of modern data handling equipment for the collection of data from pollution monitors. and meteorological instruments in a form which can be handled directly by computer. The data may be recorded directly on punched paper tape (A.E.R.E.) or on magentic tape which is subsequently translated to paper tape (W.S.L.). A further development (W.S.L.) has been in the transmission of data from a sampling site in the field to the base station; a transmission system is in operation to provide warning of the onset of high levels of pollution in London and field tests are proceeding on a system designed to explore the dispersion of pollutants from an individual source.

Abbreviations

A.E.R.E.	Atomic Energy Research Establishment
A.R.C.	Agricultural Research Council
B.C.T.D.	Blackburn College of Technology and Design
B.CeramR.A.	British Ceramic Research Association
B.CokeR.A.	British Coke Research Association
B.I.S.R.A.	British Iron and Steel Research Association
B.N.F.M.R.A.	British Non-ferrous Metals Research Association
B.P.	British Petroleum Co. Ltd.
B.R.	British Railways Board
B.R.S.	Building Research Station
C.E.G.B.	Central Electricity Generating Board
C.E.R.L.	Central Electricity Research Laboratories
D.O.E.	Department of the Environment
E.C.E.	Economic Commission for Europe
F.C.	Forestry Commission
G.L.C.	Greater London Council
I.C.A.P.R.	Interdepartmental Committee on Air Pollution Research
I.C.S.T.	Imperial College of Science and Technology
L.G.C.	Laboratory of the Government Chemist
M.I.R.A.	Motor Industry Research Association
M.R.C. : A.P.U.	Medical Research Council : Air Pollution Unit
M.R.C. : P.R.U.	Medical Research Council : Pneumoconiosis Research Unit
M.R.E.	Microbiological Research Establishment
N.A.A.S.	National Agricultural Advisory Service
N.A.P.C.A.	National Air Pollution Control Association
N.C.B.	National Coal Board
N.E.G.B.	North East Gas Board
N.E.R.C.	Natural Environment Research Council
N.G.T.E.	National Gas Turbine Establishment
N.P.L.	National Physical Laboratory
N.R.D.C.	National Research and Development Corporation
P.O.	Post Office
S.M.R.E.	Safety in Mines Research Establishment
S.R.C.	Science Research Council
W.M.G.B.	West Midland Gas Board
W.S.L.	Warren Spring Laboratory

Working Party on Odours

A Working Party has been set up by the Department of the Environment to examine the problem of unpleasant odours emitted by offensive and similar trades and to make recommendations about the best practicable means for their minimisation and suppression. This is a technological working party and in all probability its conclusions will result in the publication of a manual of advice to local authorities and those operating these trades. The Chairman is Dr. Valentin of Warren Spring Laboratory, and the Working Party includes representatives of the following bodies:

The English and Scottish Alkali Inspectorates
Ministry of Agriculture Fisheries and Food
Local Authority Associations
Confederation of British Industry
Association of Public Health Inspectors
Joint Animal By-Products Parliamentary and Advisory Committee
U.K. Association of Fish Meal Manufacturers
Torry Research Station (D.T.I.)
Water Pollution Laboratory (D.O.E.)

Mr. S. Cayton, the Society's Chairman of Council and Mr. A. C. Saword, a former Chairman, are both serving on the Working Party.

BOOK REVIEWS

107 Annual Report on Alkali, & c. Works, 1970
Department of the Environment, Scottish Development Department, Welsh Office, H.M.S.O. price 65p net.

All industrial plant which is big enough should have its own specialist team devoting its time to a study of the environmental problems of the works, says Mr. F. E. Ireland, Chief Alkali Inspector, in his annual report published recently. The team should be headed by senior members of the staff who can insist on the various operational sections carrying out their environmental protection duties correctly. They should also be able to make authoritative statements to the public and the Press when things go wrong and amenities suffer. "Many works are operating in this way and the practice should be expanded," he says.

" Ever since the first Alkali Act in 1863 the inspectorate has practised co-operation with scheduled industries and has sought to guide works to find new and better ways of reducing pollution of the environment.

" Advances have been made in several ways. Sometimes individual works have made the initial breakthrough; in others a Trade Association, often in conjunction with its Research Association, has found the answers; solutions have also been imported from other countries and been adopted by the inspectorate as best practicable means in conjunction with industry; often it was just a hard slog with greater attention to detail in design, operation and maintenance than ever before.

" Whatever the reason we have always kept closely in touch with most senior management officials, because we believe that best results are obtained by having support and drive for clean air from the chairman downwards. Through the past hundred years many industrialists have gradually learnt to have confidence in the inspectorate's judgment when leading them along new paths and setting new and tougher standards. We have to keep a constant watch on the justified demands of the public for better conditions, the practicability of improvement and the economic state of the industries concerned.

" In all this work, the question of education of those working in industry and of the general public is of the utmost importance. When we meet representatives of large industrial organisations, trade associations and nationalised industries, and when we attend conferences organised by such bodies as the Confederation of British Industries or Chemical Industry Association to discuss the cleaning of the environment, we usually find ourselves preaching to the converted. The messages need to go much deeper. They need to go to all those mainly smaller companies who could not attend or be represented. They need to go all the way down the research, development, administration and operational lines, right down to the shop floor."

Mr. Ireland continues: " An important facet of this education is the need to employ good public relations. We have always encouraged works to be as frank as possible about their emissions with local authority officers, the Press and the public, within the limitations of commercial confidence. The inspectorate is not free to release information without the permission of owners. We obtain our information by virtue of our privileged position and it is far preferable for works to tell their public neighbours what is happening. Several local liaison committees have been set up to act as a communications bridge and they have proved to be extremely useful.

" Gone are the days when a works could have a breakdown with excessive emissions to air and keep its fingers crossed in the hope that nobody would notice."

The atmospheric pollution problems of scheduled industries are considered in detail and the report includes as an appendix the latest note issued by the British Steel Corporation to its works on air pollution control requirements of the inspectorate.

The report deals with the disposal of chemical wastes. " Some wastes are too hazardous to dump or bury, or even to hide away in old mines, as is sometimes practised. Works are relieved to be able to pass difficult wastes to a contractor, who usually finds a dumping ground of his own. Occasionally small amounts can be ' lost ' in municipal incinerators or waste tips.

" Some works have their own registered incinerators, but this is still a costly and difficult method of disposal because of the frequently acid nature of the waste gases —scrubbing them poses a liquid disposal problem. A small business has grown up in sea disposal, where the collected waste is taken to a ' safe ' distance out to sea and dumped. One of the problems of incineration on land is that, where the chemical wastes contain chlorine, fluorine, sulphur, nitrogen, phosphorus compounds, and the like, the acidic combustion gases pose difficulties of corrosion of the equipment, their possible dispersion from a chimney, or the treatment of the resultant liquid effluent if the gases are scrubbed.

" On numerous occasions we have discussed with chemical manufacturers the possibility of having a few large, strategically placed, specially designed, chemical incinerators or other disposal facilities throughout the country, where manufacturers could take difficult wastes for disposal under controlled conditions.

" At present, some difficult chemical wastes from the Continent are taken by ship into the North Sea, where they are burnt in a simple incinerator on the back of the ship, whilst it sails into the wind. The authorities on shore are in constant radio contact and warn other ships to keep away from the area whilst burning is in progress. As far as possible the exercise is carried out away from the shipping lanes.

"This is a method of disposal which could expand, although the North Sea might not be the best place because of its international character, busy traffic and concern for the effects if carried out on a large scale. Most of the acid gases dissolve in the sea where there is plenty of alkaline material to neutralise them safely. A careful watch is being kept on developments in this field."

As ever the report contains a mass of information and is eminently readable. It certainly should be read by every reader of this journal and anyone interested in any way in the cause of clean air.

The Inspectorate still has its problems and there were, in 1970, 25 infractions which the report does not try to hide. 388 specific complaints were investigated in the course of 10,019 visits and inspections made during the year.

Two prosecutions were brought in 1970, one of which was for offences which occurred in 1969.

Reader Enquiry Service No. **71127**

The Gas Council, The twenty-second Annual Report and Accounts 1970/71
H.M.S.O. £1·25 net.

During the year ended March 31st, 1971, the industry continued to make good progress in its plans to convert gas supplies throughout Britain to natural gas and to expand the markets for gas so as to take full advantage of the supplies which have become available from the North Sea. Sales of gas were 6,167 million therms, 17·1 per cent higher than in the previous year. The Gas Council's high pressure transmission system was extended to the Scottish Gas Board, the last board to be connected. The appliances of two million customers were converted to the use of natural gas. The industry earned a surplus of £2·0 million, the surplus fell short of the industry's target due to delay in recovering increases in costs.

Financial Results

The industry's gross surplus for the year was £109 million compared with £102 million in 1969/70. The net surplus after payment of interest was £2·0 million compared with £13·7 million in 1969/70. The major factors influencing the financial results compared with 1969/70 were the increase in gas sales of 17·1 per cent; a reduction in the overall cost of gas supply per therm sold of 0·52p from 9·20p to 8·68p; and a reduction in the average income per therm of gas sold of 0·75p from 9·46p to 8·71p.

Five Area Boards and the Gas Council made net surpluses totalling £13·5 million and the other seven boards incurred deficits totalling £11·5 million. During the year Boards spent £89·2 million on conversion to natural gas.

There was an increase in turnover of £36·1 million compared with 1969/70. Capital expenditure during the year was £197 million, compared with £201 million in the previous year.

Gas Supplies

The aggregate quantity of gas available during the year was 6,740 million therms, an increase of 993 million therms over the previous year. The quantity of natural gas purchased was 5,212·6 million therms compared with 3,046·8 million therms in the previous year. The quantity of liquefied natural gas imported from Algeria was 666,000 tons (345 million therms).

National Transmission System

During the year a further 303 miles of pipeline were completed, giving a total operational system length of 1,899 miles.

Gas Sales

The total quantity of gas sold and used during the year was 6,167 million therms, an increase of 17·1 per cent over the previous year. Commercial sales were 8·6 per cent up. Total industrial sales were 47·0 per cent up and Area Boards' were 20·5 per cent up.

Personnel

The total number of employees in the industry on the 31st March, 1971, was 115,845, of whom 54,722 were manual workers and 61,123 were staff employees. Previous trends continued in that the total fell by 3,630 during the year.

Gas Prices

Despite inflation the gas industry has kept gas prices reasonably stable. The average income per therm realised in 1970/71 was 8·71p per therm compared with 8·88p per therm 10 years ago in 1960/61.

Suzanne Martin

Reader Enquiry Service No. **71128**

Consumers' Guide to the Protection of the Environment
Jonathan Holliman. Pan/Ballantine, in association with Friends of the Earth, 1971. 40p.

The Consumers' Guide is a very readable little book dealing with background information on environmental and consumer problems, product information on what to buy, selecting alternative brand names, what is behind the produce or process and what good or harm it causes, and how to evaluate what effects the products or processes have on the environment. Very practical help is given on how we can help conserve our environment by changing our consumer habits—such as ways to reduce consumption of energy in the home; conserving water; reducing the detergent problem and avoiding waste. For example, in the chapter on transport, this is some of the advice given on how to cut down a car's contribution to air pollution:

"Smaller cars pollute less than larger ones. They have smaller engines which get better mileage, and when the car is ready to be scrapped there is less car to be disposed of."

"Cars with fuel-injection systems are better at feeding the proper mixture of petrol and air to each cylinder than cars with carburettors."

"Keep your car in good repair. A well-tuned car (every 6,000 miles) will emit far less pollution. A dead spark-plug can increase emissions."

"Watch out for petrol leaks. Hydrocarbons that escape from a leaky tank or carburettor are just as harmful as those that come out of the exhaust pipe."

This book was based on the American book, "The User's Guide to the Protection of the Environment" by Paul Swatek for the U.S.A. Friends of the Earth.

Christine Smith

Reader Enquiry Service No. **71129**

The Electricity Council Annual Report and Accounts 1970/71
H.M.S.O. £1·80 net.

Annual Report Central Electricity Generating Board
H.M.S.O. 85p net.

Finance
During the year ended 31st March, 1971, the electricity supply industry in England and Wales made an operating profit of £205 million, compared with £306 million the previous year. After payment of interest of £261 million, the industry made a loss, for the first time since nationalisation, of £56 million.

Over the year, costs rose by £200 million to £1,596 million, the major part being attributed to massive increases in fuel prices and the heavy costs incurred in overcoming the winter fuel shortage. The net return earned by the industry was 4·1 per cent, compared with the 6·4 per cent achieved the previous year and the objective of 7 per cent set by the Government for the quinquennium from 1969/70 to 1973/74.

The steep rise in external costs made it inevitable that there should be a general increase in retail tariffs. These were kept as low as possible, 12 per cent on normal domestic tariffs and 19 per cent on off-peak rates. The increases came into effect between January and April, 1971, were estimated to produce overall additional revenue of about £130 million in a full year. The industries capital expenditure was £399 million, a reduction of £7 million on the previous year.

Sales
Despite the generally sluggish growth in the economy and the effect of a mild winter on the heating demand, sales of electricity continued to expand, total sales to 18,507,816 customers were 174,254 million units, representing an increase of 3·6 per cent compared with 5 per cent during 1969/70.

Sales to industry rose by 2·5 per cent to a total of 72,572 million units and in the commercial field by 4·3 per cent to 26,262 million units.

The Air Conditioning Advisory Bureau, sponsored by the Electricity Council, was opened in April 1970, and received over 4,000 inquiries resulting in some 4,000 kilowatts of new load.

Domestic sales increased by 4·9 per cent to 66,134 million units. Electricity Board appliance sales increased by £14·3 million to £94 million.

Generation
The power stations of the Central Electricity Generating Board produced 186,158 million units of electricity in 1970/71, an increase of 3 per cent over 1969/70. During the year 3,879 MW of new generating plant was commissioned, a total which has only once been exceeded.

Eleven 500 MW units were brought into service—including some at low preliminary ratings—and all thirteen stations built to operate 500 MW units now have plant installed and operating.

In March, 1970, the Electricity Council has adopted an estimate of 41,000 MW as the 1970/71 maximum demand in average cold spell conditions. The simultaneous maximum demand met was, in the event, 38,619 MW, and the estimated potential demand at that time was 41,110 MW.

In March, 1971, the Electricity Council adopted for the winter of 1976/77 a forecast maximum demand of 54,000 MW, which represents an average growth rate of 5·25 per cent per annum.

Transmission and Distribution
During the year, C.E.G.B's 275 kV and 400 kV transmission network was extended by 274 circuit miles to a total length of 8,728 circuit miles. The Area Board's distribution network was extended by 4,506 circuit miles.

Research
During the year the electricity supply industry spent a total of £13½ million on research, of which £3·4 million was charged to capital and £10·1 million to revenue account. This was an increase of nearly £2½ million over the previous year.

Suzanne Martin

Reader Enquiry Service No. **71130**

National Coal Board Report and Accounts for 1970-1971
H.M.S.O. respectively 55p and £1·15
In 1970-1971 the Board made an operating profit of £34·1 million. After payment of net interest charges amounting to £33·6 million, the surplus for the year was £0·5 million. The high level of demand for coal has continued, and for the third successive year exceeded production, so that heavy withdrawals were made from stocks. Total output in 1970-71 was 142·4 million tons, a reduction of 5 million tons compared with the previous year.

Deep-mining output from the Board's Collieries was 133·3 million tons, 6·5 million tons less than in 1969-70. Production from opencast sites amounted to 8·3 million tons and from licensed mines and other N.C.B. sources to 0·8 million tons. After 12 years of continuous contraction, the Board took measures to stabilize output. The average productivity of 44·2 cwt. a manshift was the highest ever recorded and 1·7 per cent higher than 1969-70.

A major reason for the shortfall in output was the loss of 3·3 million tons of output as a consequence of the mineworkers' unofficial strike in the autumn. This cost the Board nearly £13·5 million, of which nearly £13 million was on their mining operations. Wage increases for industrial employees and others granted during the year increased costs by £20 million in 1970-71. Continuing inflation in the price of purchased goods and services increased costs in the year by about £24 million.

The improvement in productivity was insufficient to offset increases in expenditure arising from the pay settlements and inflation, and the Board were obliged to increase prices during the year.

The Coal Industry Act 1971, provides for part of the social costs of colliery closures to be met by grants from the Exchequer up to an amount not exceeding £24 million for the three years ending 30 March 1974, but the Government's contribution will be in diminishing proportions. The Act also extends for three years the power of the Secretary of State for Trade and Industry to make redundancy payments schemes for workers in the coal mining industry.

The Act increases the limit on the Board's accumulated deficit on revenue account from £50 million to £75 million, with provision for further extension, with

the approval of the Treasury, up to £100 million, and enables the Board to borrow otherwise than by way of temporary loan on foreign currency. It also enables the Board, with the consent of the Government, to provide technical assistance for developing countries.

The Board sold 18·3 million tons of solid fuel in the domestic market in 1970-71, a decrease of 2·0 million tons compared with 1969-70. Sales of bituminous house coal decreased by 1·8 million tons to 13·8 million and sales of the Board's naturally smokeless and manufactured fuels decreased by 0·2 million tons to 4·5 million.

At the start of the fiscal year, 1970-71, it seemed likely that there could be a serious shortage of domestic smokeless fuel during the winter because of the accelerated run-down in gas coke production and the almost total withdrawal of supplies of domestic coke by the steel industry.

Local Authorities were advised to defer new smoke control orders as a temporary measure and, in areas where there was a particular risk of difficulties, to suspend some existing orders. Meanwhile the Board and the independent producers of smokeless fuels did all they could to maximise outputs. The Board also arranged to use surplus processing capacity in France to manufacture smokeless briquettes (Fireglo) from Welsh anthracite duff. In the Board's view these measures would have ensured that solid fuel supplies were adequate during the winter. In the event, consumer demand was considerably eased by the mild winter weather, and distributors finished with higher stocks than normal. This, coupled with progress in increasing fuel manufacturing capacity, means that there should be no general supply difficulties in future. The Report assures householders and Local Authorities that they can confidently invest in new heating installations and smoke control programmes as suitable smokeless fuel will be available.

The Report announces important developments in the field of domestic appliances using new techniques. Two improved versions of the "Housewarmer" (a glass-fronted Roomheater designed to burn bituminous coal smokelessly) are now on the market. Both appliances offer higher heat outputs than the original "Housewarmer" and in most parts of the country the running costs should be lower than for other forms of heating.

There were also a number of developments which are likely to be of long term importance to the domestic market for solid fuel. Discussions took place with the heating trade on the terms of a new N.C.B. Guarantee Scheme, to be introduced in 1971-72, giving a two-year guarantee to householders having solid fuel heating systems installed by Board-approved installers.

Christine Smith

Reader Enquiry Service No. **71131**

Solid Smokeless Fuels Federation Report for Fifteen Months from 1 January 1970-31 March 1971

The Federation entered this period accepting the possibility that there could be temporary difficulties in the supply of solid smokeless fuels, especially in parts of the country where gas works closures had been particularly severe. Throughout the winter very close contact was maintained by the Federation with the Local Authorities, the fuel distributive trade and the Ministries. Every case where a Local Authority requested a suspension was considered on its merits by the Regional Officer and although decisions erred on the side of safety, only 105 Local Authorities did suspend any of their smoke control orders. The Report continues that additional action taken by industry helped to ease the position even further. The Solid Smokeless Fuel producers did everything possible to maintain production and in the majority of cases output from coke ovens was in excess of designed production figures.

During the fifteen months, only 249 smoke control orders were made by Local Authorities and submitted to the Department of the Environment for confirmation whilst 243 orders were confirmed by the Minister, compared with 280 during the 12 months period of 1969.

The Report states that meetings to assess the supply and anticipated demand for Solid Smokeless Fuels and the conditions likely to apply during the winters of 1971/72 and 1972/73 have been held regularly. It was noted with satisfaction that the production plans of the producers are up to schedule and that the effect of the additional production from new plant brought into operation during the year has already been felt.

The Report also gives details of exhibition activities and Regional Organisation.

Reader Enquiry Service No. **71132**

Environmental Health Report 1970
Association of Public Health Inspectors. 25p.

The 7th Environmental Health Report is not only the record of the work carried out by public health inspectors in 1970, but also a representative picture of the state of environmental health of the whole country.

The Report stresses that in the impending local government reorganisation all environmental health functions should be the responsibility of one authority only, and in a two-tier system, this should be the District Council. Any splitting up of the duties of the public health inspector, whose value has been established over more than a century, would debase the quality of the service. It would not be in the public interest as it could only lead to inefficiency, duplication of effort and additional expense.

The Report deals with a number of subjects relating to environmental health, including food inspection; working conditions in offices and shops; housing; public cleansing; clean air; industrial pollution and noise. In the section on clean air local authorities are urged to put smoke control high on their lists when considering budgets because in the long term the benefits to health more than justify such action, particularly in the large urban conurbations. The Report says that the general position with regard to industrial pollution is much less satisfactory than it should be, except in the case of smoke emission. What gives rise to so much concern is the emission of grit, dust, fumes, gases and odours. Local Authorities are urged to carry out regular inspections and surveys of industrial premises, not only to deal with current problems, but to identify potential problem sources, and carry out checks on air pollution control equipment. In far too many cases appliances are installed which work satisfactorily for a while and then lose their efficiency because they are not properly maintained.

The Report states that the noise complaints have increased steadily every year and in 1970 public health

inspectors dealt with 9,813 complaints. In 5,658 cases it was considered that a statutory nuisance existed. 2,744 of these involved industrial noise; 1,589 commercial and 1,315 domestic noise. After discussing the problems of traffic and industrial noise, the Report refers to the Association's proposal that local authorities should have the power to declare noise control areas in the same way that they now declare smoke control areas.

Regarding aircraft noise the Report states that controlling noise at airports is not the answer to the problem of aircraft noise, although all possible steps should be taken to minimise the nuisance as far as possible. The development of a really quiet aircraft is the only solution to reducing noise nuisance to reasonable levels.

For the second year the work of public health inspectors in Northern Ireland is included.

Christine Smith

Reader Enquiry Service No. **71133**

Can Britain Survive?
Edited by Edward Goldsmith.
Tom Stacey, 1971. £3·00.

The authors of this book include ecologists, environmental researchers, a professor of economics and other pioneers in the field of pollution control and conservation. Their work has been commissioned and brought together by the editor of "The Ecologist", Edward Goldsmith.

The introduction states that "all evidence presented in this book tends to show that progress is not necessarily the boon we think it is and that in any case it ceases to be desirable once a certain degree has been achieved. This evidence, however, is psychologically unacceptable to most of us, and we find ourselves forced to seek to interpret the data on which it is based in such a way as to be led to different conclusions. Our plight, we try to pursuade ourselves, is due to certain tendencies which may occasionally accompany economic growth, and hence progress, but which can easily be avoided if we take the necessary trouble . . . a little pollution control here and there, and all the economic growth we want becomes reconcilible with the conservation of our environment".

In a series of essays divided into five parts, dealing with "Limits of Growth"; "Food"; "Diminishing Resources"; "Pollution"; "Social Consequences" and a conclusion "What of the Future?" the book attempts to predict the economic future of this country, by collecting the maximum amount of relevant data, regardless of the discipline of which it is normally part. It shows how the various disciplines are inter-related and provides "A dynamic model of Britain as a social and economic system".

The conclusion points out that to treat symptoms is to render the disease correspondingly more tolerable and therefore contribute to its perpetuation. We must not blame all ills on technicalities and leave the real causes untouched.

Christine Smith

Reader Enquiry Service No. **71134**

Catalytic Conversion of Automobile Exhaust, 1971
John McDermot. Noyes Data Corporation, New Jersey, U.S.A.

This 200 page publication contains Patent descriptions of over 100 devices in connection with the catalytic oxidation of the incompletely burned products of combustion in automobile exhausts.

For anyone interested in this subject it covers very many patented ideas concerning the hardware and the catalysts; some valuable and some unpractical.

It is surprising the number of inventors that have climbed on to this band-wagon in the U.S.A.

In the U.K. it is preferred to aim at more complete combustion within the engine, thus utilising the fuel more fully and avoiding what must be extraneous hardware involving expensive servicing and replacement (especially if it is to remain effective) as well as extra weight and appreciably high first cost.

Philip Draper

Reader Enquiry Service No. **71135**

New additions to the National Society for Clean Air Library, available on loan

Sir Stanley Brown. The Next 25 Years in the Electricity Supply Industry. Lecture to the Institution of Electrical and Electronics Technicians Engineers, London, November 1970. Central Electricity Generating Board, 1971.

Sir Frank Fraser Darling. Wilderness and Plenty: the eloquent statement of the dependence of all living things on one another. The Reith Lectures, 1969. Ballantine, 1970.

Paul Brooks. Roadless Area. Sierra Club/Ballantine, 1971.

Edward Goldsmith, editor. Can Britain Survive? Tom Stacey, 1971.

J. Parker. Transport of Air Pollution from the Scunthorpe Area. Dept. of Trade and Industry, Warren Spring Laboratory. LR 126(AP) 1970.

D. W. Scott. Measurement of Total Oxidants in the Atmosphere. Dept. of Trade and Industry: Warren Spring Laboratory. LR 140(AP) 1970.

P. Clayton. Brickworks Odours—A Subjective Evaluation of a Removal Process. Dept. of Trade and Industry: Warren Spring Laboratory. LR 131(AP) 1970.

Werner Strauss, editor. Air Pollution Control, Part One. Wiley-Interscience, New York, 1971.

John McDermott. Catalytic Conversion of Automobile Exhaust. Noyes Data Corporation, New York, 1971.

Dr. Paul R. Ehrlich and Richard L. Harriman. How to be a Survivor: a plan to save spaceship Earth. Ballantine, 1971.

Greg Cailiet, Paulette Setzer and Milton Love. Everyman's Guide to Ecological Living. Sponsored by the Santa Barbara Underseas Foundation. New York, Macmillan, 1971.

Michael Allaby. The Eco-Activists: youth fights for a human environment. Charles Knight, 1971.

Jonathan Holliman. Consumers' Guide to the Protection of the Environment. Pan/Ballantine, in association with Friends of the Earth, 1971.

National Coal Board. Report and Accounts, 1970-71. H.M.S.O., 1971.

Central Electricity Generating Board. Annual Report and Accounts, 1970-71. H.M.S.O., 1971.

The Electricity Council. Annual Report and Accounts, 1970-71. H.M.S.O., 1971.

Solid Smokeless Fuels Federation. Report for the Fifteen Months from 1 January 1970-31 March 1971.

Association of Public Health Inspectors. Conference Proceedings, Eastbourne, 1971.

Association of Public Health Inspectors. Environmental Health Report, 1970.

U.S. Environmental Protection Agency. Air Pollution Aspects of Emission Sources: Electric Power Production. A Bibliography with Abstracts. Office of Air Programs Publication No. AP-96, 1971.

U.S. Environmental Protection Agency. Guide for Control of Air Pollution Episodes in Small Urban Areas. Office of Air Programs Publication No. AP-78, 1971.

U.S. Environmental Protection Agency. Guide for Control of Air Pollution Episodes in Medium-Sized Urban Areas. Office of Air Programs Publication No. AP-77, 1971.

U.S. Environmental Protection Agency. Guide for Air Pollution Episode Avoidance. Office of Air Programs Publication No. AP-76, 1971.

U.S. Environmental Protection Agency. Guidelines: Air Quality Surveillance Networks. Office of Air Programs Publication No. AP-98, 1971.

U.S. Environmental Protection Agency. Photochemical Oxidants and Air Pollution: an annotated Bibliography. Part I. Categories A through F. Part 2. Categories G through N and indexes. Air Pollution Control Office Publication AP-88, 1971.

U.S. Environmental Protection Agency. Effects of Fuel Additives on Air Pollutant Emissions from Distillate-Oil-Fired Furnaces, by G. B. Martin, D. W. Pershing and E. E. Berkau. June, 1971.

Fuel Oil Firing Courses

N.I.F.E.S. announce that owing to popular demand their fuel oil firing courses are to be provided with residential facilities in the future. Arrangements have been made for the next series to be held at the Lancaster Gate Hotel, 106 Lancaster Gate, London W2 3NU, to take place as follows:

Course 4	17th—20th January	1972
Course 5	14th—17th February	1972
Course 6	20th—23rd March	1972
Course 7	10th—13th April	1972
Course 8	15ht—18th May	1972
Course 9	5th—8th June	1972

The fee for the course will be £60, inclusive of meals and accommodation.

For further information write:

Mr. L. F. Linnett, B.Sc., C.Eng., M.Inst.F., A.F.Inst.Pet., N.I.F.E.S., Abford House, 15 Wilton Road, London SW1V 1LZ.

National Society for Clean Air

134-137 North Street, Brighton BN1 IRG (Brighton 26313)

The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

National Society For Clean Air

NEWS FROM THE DIVISIONS

NORTH EAST

On the 1st October, 1971, a meeting of the North East Division was held in the Washington Suite of the Five Bridges Hotel in Gateshead. The first half of the meeting was devoted to a discussion on the proposed constitution of a Divisional Council. The Honorary Secretary, who unfortunately was not able to be present because of illness, had prepared a draft document outlining the constitution of the proposed Council, wherein he had suggested that the Council comprise of ten members in addition to the Chairman, Vice-Chairmen and Secretary who would be ex officio members. The composition of the members would be determined on a proportional representational basis and it was suggested that Corporate members would be represented by two representatives, Individual members by one representative and Local Authorities by seven representatives. Considerable discussion ensued but it was finally agreed that the Local Authority members be constituted on the basis suggested by the Secretary with three members from County Boroughs, one from Municipal Boroughs, two from Urban Districts and one representing Rural District Councils and County Councils. On this basis the Secretary was authorised to seek the general approval of the Executive Council to the constitution of the Divisional Council as agreed.

The Chairman then introduced Mr. J. A. Nowill, Senior Industrial Fuels Sales Engineer of Shell-Mex and B.P. Limited, who delivered an address entitled "The Activities of the Oil Industry in the Reduction of Pollution". Mr. Nowill gave an extremely informative and lucid dissertation on the emergence of public opinion in relation to anti-pollution measures and whilst he mentioned various aspects of world interest in pollution, he made particular reference to measures in which the Oil Industry had been particularly active. Although world oil consumption had doubled during the past 10 years pollution from sulphur dioxide had not increased at the same rate because of the efforts of the Oil Industry to secure reduction in the sulphur content of oils now being distributed. This was achieved by exploration and finding new sources of low sulphur oil or by researching into new methods of desulphurisation, although the cost of sulphur reduction in this way was proving to be a formidable obstacle.

Mr. Nowill described the diesel engine as one of the cleanest methods of transport and, indeed, advocated the increased use of diesel oil when compared with the more polluting effect of the petrol engine. The speaker then went on to describe the efforts of the Oil Industry in dealing with the prevention of pollution of water and described the development of new detergents designed to be effective without adversely affecting bacteriological action in sewage disposal plants. Mr. Nowill then surprised some of the audience by referring to the fact that each year there was the equivalent of two "Torrey Canyon" cargoes of crude oil released in the Mediterranean and he mentioned in this connection the use of phosphatic detergents which, in their long term use, would lead to the deoxidation of sea water and the resultant damaging effect on marine life.

Finally he referred to the increasing use of North Sea gas, the sources of which would not have been revealed were it not for the exploratory efforts of the Oil Industry who had pioneered the North Sea search for underwater fuel.

Delegates then were shown two films produced by the Oil Industry, the first entitled "Shadow of Progress" dealt with all aspects of world wide pollution and outlined, in general terms, the Oil Industry's interest in pollution abatement. This was followed by a brand new film "Flash Up" which was having its first showing to a public audience. This film demonstrated various applications of oil firing in industry and, in particular, dealt with the various ways of overcoming conversion difficulties when changing over from solid fuel to oil firing.

After a general discussion members were entertained to tea and biscuits by the kind hospitality of Shell-Mex and B.P. Limited and the Chairman drew the meeting to a close by extending, on behalf of all members, grateful thanks to Mr. Nowill and the Shell-Mex Representatives who had made the meeting such a success.

L. Mair
Hon. Secretary

Environmental Pollution in the North East

During the last 12 months the Working Group of the Northern Region of the Economic Planning Council have been examining the position of the Northern Region in regard to environmental pollution. Their investigation arose from the publication of the White Paper "The Protection of the Environment" and it was felt that it was important for the Northern Region that those aspects of pollution having particular relevance to economic planning should be studied in depth. The Working Group was appointed in July 1970, since when it held seven meetings during the course of which study they consulted various persons interested in the subject, including the Honorary Secretary of the North East Division, L. Mair, who is also Chief Public Health Inspector of the City and County of Newcastle upon Tyne. The report, which has been circulated to all local authorities and other interested bodies in the region and to Mr. Peter Walker, Minister for the Environment, is divided into separate sections dealing with—

(a) pollution of the air;
(b) pollution by noise;
(c) pollution of the land;
(d) pollution of water;
(e) pollution of sea and beaches; and
(f) pollution by radio activity.

In relation to air pollution the report emphasises that the Northern Region generally and the Tyneside Conurbation in particular, still lags behind the rest of the country in terms of the number of premises covered by smoke control orders in " black areas ". It points out that less than 30 per cent of the premises within the black areas of the Northern Region are covered by smoke control areas, whereas the average for the country is 55 per cent and only the South West Region has a percentage lower than the Northern Region.

The report focuses attention on the exceptional problems of atmospheric pollution in the Teesside area arising from the heavy iron and steel, chemical and petrochemical industries. This chemical complex is the largest in Europe and consists of some of the largest chemical process units in the world and the main difficulties appear to arise from old plants with a limited life which do not justify the expense of fitting modern arrestor equipment. The report states that the technology of pollution control for new plants is well advanced, although small faults in the operation of a plant on the scale involved can produce a large amount of pollution. Particular reference is made to the phenomenon known as "Teesside Mist" which, the report states, must be recognised as a serious blemish and which must be brought under control. This mist is created when ammonia is discharged into an atmosphere already polluted with sulphur dioxide and thus heavy mists are formed. Although stringent precautions are taken to control ammonia plants leaks can occur accidentally or during short periods of start up and shut down. The presence of sulphur dioxide at ground level presents a difficult problem as it is from domestic fuels that the sulphur dioxide is disposed of at these lower levels.

The report continues by referring to other sources of pollution from the oil and steel industrial operations in Teesside and at Consett. Hopes for an improvement are based on the abandonment of the old type of open hearth furnace, which is a high emitter of grit and dust, and which are gradually being replaced by new basic oxidation steel plants which incorporate modern arrestor equipment. Reference is made to the particular problem in Teesside where dust and grit are created by the handling of iron ore, both during discharge from ships and during treatment in sinter plants, but modern arrestor equipment which has been commissioned for the Consett works has required substantial modifications because of corrosion problems and steps are being taken to meet these difficulties by the use of stainless steel in the precipitators.

The section of the report dealing with air pollution refers to pollution from power stations and future problems of planning in relation to the siting of power stations and concludes by mentioning pollution from motor vehicle exhausts. The report points out that although there are fewer cars per capita in the region than in the rest of the country, the number of motor vehicles can be expected to increase substantially if the Planning Council's aim to increase the economic standard of the region is achieved. The Working Party, therefore, welcomes the Government's proposed measures to control the harmful content of vehicle exhausts.

The Working Party in their recommendations emphasise that priority should be given to extending the smoke control areas in the region and the Tyneside Conurbation is singled out for special comment in this connection.

SOUTH WEST

A delegation of three members of the Divisional Council met five representatives of the Bristol Branch of the Conservation Society at their request in September in order to discuss matters of common interest. The meeting lasted for some 1½ hours, and the Secretary of the Bristol Branch of the Conservation Society explained the aims and activities of his branch. A series of public meetings is planned by the Conservation Society in Bristol, leading up to the staging of the United Nations Conference on the Human Environment next year. An Exhibition is planned by the Conservation Society, possibly in the autumn of next year, and it was agreed in principle that the South West Division of the National Society for Clean Air would participate in this. It was also agreed that the Division would provide a speaker to address one of the meetings on Air Pollution and its control. This proved to be a most useful meeting, and probably the first of many, as there are certain common interests between our Society and the Conservation Society.

A meeting of the South West Division was held on Tuesday, 26th October, 1971, at the Associated Portland Cement Manufacturers Limited's Works situated at Westbury, Wiltshire. The Divisional Council met in the morning and the more important items of business which were discussed were smoke control progress and recruitment of new local authority members. It was decided that the Secretary should write to the major local authorities in the South West who had not implemented Smoke Control Orders, and that he should also write to local authorities who were not members. It is hoped that this action will provide a significant increase in the membership of the South West Division.

At the conclusion of the morning's business members of the Divisional Council were entertained to lunch by the Company. The afternoon meeting was well attended and the main business was a tour of the works to see the production of cement, with particular emphasis on measures taken to control air pollution. Members were reassured to see the measures taken to control emissions to atmosphere. At the conclusion of the tour of the works members of the management answered questions put to them by members of the Division and this was followed by a short discussion.

A vote of thanks to the Company for the facilities given to the Division and for their hospitality was moved by the Chairman, Alderman C. Hebblethwaite, C.B.E.

D. J. Barnett
Hon. Secretary

"Air Knows No Frontiers"

INTERNATIONAL NEWS

WEST GERMANY

A clean-air lottery for motorists has been announced by North-Rhine Westphalia as part of the state's anti-pollution campaign. Drivers who take a five minute carbon monoxide test and carburettor adjustment will receive numbered certificates. Holders of the lucky numbers will win prizes. First prize is a fume-free car.

U.S.S.R.

In the past ten years about 200 factories which polluted the atmosphere have been closed down or moved out of Moscow and many more have had their equipment modified. The latest to be adapted, according to the Soviet News Agency Tass, is an aluminium alloys factory in which the boiler room was converted to gas heating and where electric furnaces were installed.

JAPAN

Tokio Metropolitan Government is considering building a study-recreation camp for 600 school pupils in a forest on the town's outskirts because of worsening air pollution and noise in Tokio.

SWEDEN

In June next year the United Nations will hold a world conference on the human environment. Delegates from all over the world will gather in Stockholm to discuss pollution and other environmental disequilibria of various kinds. All the usual facilities will be laid on by the host government, including a chauffeur-driven car for each delegation.

In addition, however, Sweden will supply 200 bicycles for the truly environment-conscious visitors. These machines will be painted in the United Nations colours of blue and white, and will be provided on a communal basis—First come, first served. Delegates left behind in the rush will either have to walk or, final humiliation, be seen in a car polluting their host city.

U.S.A.

Los Angeles is notorious for its smog. Time and again we have heard of traffic there being brought to a complete standstill because of the dense pall of smoke and fog that seems to bring the entire city to a halt. But the United States Postal Service believes that something must—and can—be done about it.

Their answer is to reduce the smog-producing agents generated by cars and trucks by using battery-operated electric vehicles for postal collections and deliveries. So they are putting an electric mail van through its paces in the nearby town of Cupertino. The electric mail van being used in the test was made in Britain.

Aircraft Pollution Study Commissioned

Aircraft pollution studies at the Northern Research and Engineering Corporation have been commissioned by the Environmental Protection Agency. The contract includes a summary of total aircraft emissions at selected air bases and airports and the development of a computer programme for use in calculating total emission rates from individual airports and pollutant concentration levels.

MEXICO

Modern blights such as smog and traffic congestion are endangering the traditional Mexican siesta in Guadalajara. The problem is plaguing the city to such an extent that it was discussed at an urban planning seminar conducted by the Mexican North American Cultural Institute. It was decided that the siesta would have to go because it was one of the prime causes of traffic and air pollution.

The result of people taking two hours off in the afternoon and then returning to work was the cause of unnecessary traffic jams.

ISRAEL

After years of patient suffering, the citizens of Haifa have gone over to the attack on the air pollution front. The Public Council for the Preservation of Environmental Quality, founded about a year ago, and its chairman, Mr. Antonio Peranio, an engineer, have applied to the Ministers of Health and the Interior to enact regulations laying down safety standards on air pollution and limiting maximum emission of pollutants at a given time and place.

The application is based on the Law for the Prevention of Public Nuisances (The Kanowitz Law) of 1961 which makes it an offence to pollute the air and calls for the enactment of regulations to make it technically and legally practicable to bring polluters to book.

For the past ten years the Law has remained unused as successive Ministers of Health and the Interior have failed to pass the technical regulations defining when the emission of noxious substances, smoke, fumes, gases, soot etc., becomes a public nuisance and a health hazard.

SMOKE CONTROL AREAS

Progress Report

Position at 30 September 1971

(Figures supplied by the Department of the Environment)

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 1.7.71 ..	3,461			8			166			36		
Acres		979,842			1,097			89,609			9,100	
Premises			4,842,078			4,979			424,034			17,890
Smoke Control orders Confirmed (1.7.71–30.9.71)	59			—			8			1		
Acres		27,049			—			7,475			300	
Premises			108,145			—			14,057			1,721
Grand Totals	**3,520**	**1,006,891**	**4,950,223**	**8**	**1,097**	**4,979**	**174**	**97,084**	**438,091**	**37**	**9,400**	**19,611**
Smoke Control Orders Submitted (1.7.71–30.9.71)	57			—			3			—		
Acres		17,390			—			326		—		
Premises			75,358			—			1,110			
Smokeless Zones (Local Acts) in operation	44			—			—			—		
Acres		3,400			—			—			—	
Premises			41,060			—			—			—

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30 September 1971

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	45,257	36·1	177,730	32·1
Yorkshire & Humberside	198,253	52·6	676,365	57·9
East Midlands	71,914	26·8	211,122	41·2
Greater London	253,092	77·4	2,207,669	83·6
North Western	205,495	51·2	859,865	50·5
West Midlands	86,964	34·9	402,257	38·3
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	868,480	49·0	4,563,705	58·7
Outside black areas ..	138,411		386,518	
Grand Totals	**1,006,891**		**4,950,223**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Autumn 1971)** *which gave the position up to* **30 June, 1971.** *They now show changes and additions up to* **30 September, 1971.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Tyneside and Wearside

Wallsend B. (No. 5). Newburn U.D. (Nos. 12 and 13). Tynemouth C.B. (No. 11).

Yorkshire

West Riding (North)

Leeds C.B. (Nos. 78 and 85). Aireborough U.D. (No. 27). Horsforth U.D. (Nos. 29(a) and 29(b)). Huddersfield C.B. (Marsh-Grimiscar). Pudsey B. (Tyersal).

West Riding (South)

Barnsley C.B. (No. 12).

North Western

South Lancashire and North-East Cheshire

Salford C.B. (No. 17). Altrincham B. (No. 9). Eccles B. (No. 14). Hyde B. (No. 7). Middleton B. (Langley No. 100 and Heywood Old Road (No. 17)). Failsworth U.D. (No. 9). Royton U.D. (No. 6).

Central Lancashire

Oswaldtwistle U.D. (No. 2).

Merseyside

Wallasey C.B. (No. 15). Warrington C.B. (No. 15). Bebington B. (Nos. 18, 20 (stage 4) 21 and 22).

Midlands

Derby, Nottingham and Chesterfield

Arnold U.D. (No. 4).

West Midlands

Halesowen B. (No. 32). Aldridge Brownhills U.D. (No. 33).

Potteries

Kidsgrove U.D. (No. 18). Stoke-on-Trent C.B. (No. 24).

London

Greater London Boroughs

Hillingdon L.B. (No. 15). Bromley L.B. (No. 12). Barnet L.B. (No. 11). Harrow L.B. (No. 22).

Local Authorities Outside the Black Areas

Winsford U.D. (No. 10). Swadlincote U.D. (No. 2). Canterbury C.B. (Downs Rd. No. 1; Westgate No. 2; Tennyson No. 3). Ripley U.D. (No. 2/1970). Rugby B. (No. 13). Southampton C.B. (No. 10).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Tyneside and Wearside

Jarrow B. (No. 5). South Shields C.B. (No. 7). Newcastle upon Tyne C.B. (No. 14). Boldon U.D. (No. 18).

Teesside

Hartlepool C.B. (No. 21). Teesside C.B. (No. 7). Darlington C.B. (No. 6).

Yorkshire

West Riding (North)

Bradford C.B. (Bradford Moor). Wortley Rd. (Grenoside). Leeds C.B. (Nos. 93 and 94). Huddesfield C.B. (Gedholt-Birkby, 1971). Pudsey B. (Nos. 10 and 11).

West Riding (South)

Darton U.D. (Nos. 15, 16 and 17). Dearne U.D. (No. 7). Hoyland U.D. (No. 1). Sheffield C.B. (No. 22).

North Western

South Lancashire and North-East Cheshire

Sale B. (No. 12). Audenshaw U.D. (No. 6). Blackrod U.D. (No. 3). Bury C.B. (No. 9). Farnworth B. (No. 5). Salford C.B. (Nos. 19 and 21). Middleton B. (Langley No. 10D).

Central Lancashire

Blackburn C.B. (No. 11). Rawtenstall B. (Nos. 4 and 5). Oswaldtwistle U.D. (No. 3).

Merseyside

Bebington B. (No. 14). Birkenhead C.B. (No. 8). Runcorn U.D. (No. 8).

Midlands

Derby, Nottingham and Chesterfield

Derby C.B. (No. 22). Kirkby-in-Ashfield U.D. (Nos. 5 and 6).

West Midlands

Birmingham C.B. (Nos. 157 and 158). Coventry C.B. (No. 15). Wolverhampton C.B. (No. 15).

London

Greater London Boroughs

Bromley L.B. (Nos. 13, 14 and 15). Harrow L.B. (No. 24). Hounslow L.B. (Brentford and Chiswick No. 12; Heston and Isleworth Nos. 22, 23 and 24). Sutton L.B. (No. 24).

Outer London

Dartford B. (No. 11).

Local Authorities Outside the Black Areas

Peterborough C.B. (No. 2). Reading C.B. (No. 16). Rugby B. (No. 14). Staines U.D. (No. 12). Southampton C.B. (No. 11). Grantham B. (No. 19).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Tyneside and Wearside

Hebburn U.D. (No. 13). Tynemouth C.B. (No. 12).

Teesside

Teesside C.B. (Nos. 8 and 3 Elm Tree Farm, Stockton). Darlington C.B. (No. 7).

Yorkshire

West Riding (North)

Baildon U.D. (No. 12). Leeds C.B. (No. 95). Halifax C.B. (Nos. 17b and 18b).

West Riding (South)

Darton U.D. (No. 18). Conisbrough U.D. (No. 2).

North Western

South Lancashire and North-East Cheshire

Stockport C.B. (Shaw Heath, Cale Green (S) and (N)). Hyde B. (No. 8). Irlam U.D. (No. 5). Urmston U.D. (No. 11). Worsley U.D. (No. 10). Stretford B. (No. 15). Altrincham B. (No 10).

Central Lancashire

Ramsbottom U.D. (No. 4). Colne B. (No. 9). Nelson B. (No. 7).

Merseyside

Runcorn U.D. (No. 7). Ellesmere Port B. (No. 11). Huyton with Roby U.D. (No. 8). Wallasey C.B. (No. 16).

Midlands

Derby, Nottingham and Chesterfield

Nottingham City (No. 6a). Ilkeston B. (No. 6). Chesterfield R.D. (No. 13). Buxton B. (Fairfield No. 1).

North Midlands.

Leicester C.B. (Nos. 28 and 29).

West Midlands

Sutton Coldfield B. (No. 20). Stourbridge B. (No. 29). Halesowen B. (No. 33). Aldridge-Brownhills U.D. (Nos. 30, 31 and 34). Stourbridge B. (No. 30).

London

Greater London Boroug

Sutton L.B. (No. 23). Merton L.B. (No. 19). Brent L.B. (No. 7). Barnet L.B. (No. 13).

Local Authorities Outside the Black Areas

High Wycombe B. (No. 17). Burton-upon-Trent C.B. (No. 2). Glossop B. (No. 5). Whiston R.D. (Halewood No. 1). Hazel Grove and Bramhall U.D. (No. 7). Lincoln C.B. (No. 4). Whitley Bay B. (Nos. 7 and 8). Warrington R.D. (Nos. 5 and 6). Whickham U.D. (No. 10). Southampton C.B. (No. 12). Tamworth B. (No. 6).

SCOTLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Midlothian (Livingston New Town Designated Area No. 2). Renfrew County (New Erskine Community).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Clydebank (Whitecrook No. 9). Dumbarton Burgh (No. 10). Dundee (Fintry). Edinburgh (Murrayfield/Cramond No. 3 (part 2); Colinton No. 1; Pilton No. 2). Fife County (Glenrothes Nos. 2 and 3).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Lanark County (Bankhead No. 1). Port Glasgow (No. 7). Stirling County (Mitton of Campsie).

NORTHERN IRELAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Downpatrick U.D. (No. 2).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Castlereagh R.D. (No. 5).

Smoke control progress in Wrexham

Due to an error, for which we apologise, Wrexham Borough Council was unfortunately omitted from the smoke control area progress reports in the Clean Air Year Book 1971-72.

Yet Wrexham, the largest Borough in North Wales, with a population of nearly 38,000, and which is outside the "Black Areas", has three Smoke Control Areas in operation.

The Borough Council, through its Health Committee, have for very many years, taken a lively interest in the necessary measures for combating pollution of the atmosphere. Industry has never presented a very serious problem, and the main effort of the Council has been directed to reducing pollution from domestic chimneys.

The three Smoke Control Orders at present in operation cover 862 acres and 3,943 premises. The first Order came into operation in 1962, and it was hoped at that time, that the whole of the Borough would be smoke controlled by 1977. A further Smoke Control Order is due to become operative on October 1st, 1972. This will cover an area of 341 acres and affect 2,935 premises. When this comes into operation, about half the premises in the town will be subject to smoke control.

It is unfortunate that the problems which have had the effect of slowing down progress nationally have also been experienced in Wrexham, and it is now expected that the clean air programme will not be completed until about 1979/80. However, despite this brake on its progress towards a cleaner atmosphere, Wrexham still leads the field in formal smoke control measures in the Principality. A phased programme covering the remainder of the town has been approved by the Council, and provided the key factors of fuel and finance can be overcome, the Borough Council is confident that Wrexham will be virtually smokeless before the end of this decade.

Symposium on Noise and the Industrial Use of Fuel

The Institute of Fuel are holding a Symposium on "Noise and the Industrial Use of Fuel" on the 7th January 1972. Further details of this Symposium and registration forms may be obtained from:

Hon. Secretary, P. J. Jackson, The Institute of Fuel, Blue Haze, Stanbridge Earls, Awbridge, Nr. Romsey, Hants.

AIR POLLUTION ABSTRACTS

1255 Economics of Oil-Fired District Heating. (J. of Fuel and Heat Tech. 18(5) Sept. 1971). Today, as a result of developments in Europe and the U.S.A. and the solution of technical problems, district heating now seems set for a rapid rise to ascendancy over other systems of heating in the U.K. Many kinds of group heating schemes have been called district heating, but the definition now generally accepted is that it applies to the heating of a number of units or blocks of units from a central boiler house or boiler houses by means of piped steam or hot water. In other words the heat is generated in one or more large plants and carried by pipe line to a number of houses, offices, shops, factories and public buildings, or to a number of blocks of flats. In the U.K. there are now probably well over 100 such schemes serving over a quarter of a million homes or other units.

1256 Effects of Fluoride on Agriculture. Weinstein, Leonard H., and McCune, Delbert C. (J. of Air Poll. Control Assoc. 21(7) July 1971). The effects of atmospheric fluorides on plants are summarized with respect to the level of biological organization at which they occur. The factors that determine the occurrence and degree of these effects are reviewed briefly. A series of economic effects on agriculture is postulated and its possible relationship to the botanical effects of fluorides is discussed.

1257 Lead Poisoning in Horses; an Environmental Health Hazard. Schmitt, Nicholas, et al. (Arch. Environ. Health. 23(3) Sept. 1971). Excessive amounts of lead in ingested forage were found to be the primary cause of a chronic debilitating disorder in six horses. The high lead levels in forage were related to the presence of lead in surface soil accumulated from emissions of a nearby smelter. This study has demonstrated that young horses have a high susceptibility to toxic effects of lead. Older horses and cattle are more resistant. Testing of air, water, and human foodstuffs did not reveal evidence of a significant human hazard. The co-operation of various government agencies at the federal, provincial, and local levels, together with private industry, has proved to be a highly effective approach to the investigation of a complex environmental pollution problem.

1258 Ironfoundries and the Requirements of Clean Air Legislation. Shaw, F. M. (Iron and Steel, (44(3) June 1971). Over the next few years the legislation dealing with industrial pollution will become increasingly more strict. This paper examines the situation as it effects iron foundries, together with some of the preventative measures which are available.

1259 Everyman's Guide to Ecological Living. Cailliet, Greg; Setzer, Paulette, and Love, Milton. (Macmillan, New York, 1971). Provides advice and suggestions about activities that concerned people can undertake to relieve the impending environmental crisis. It is a manual for people who want to adapt their lifestyles in order to be less a part of the environmental deterioration problem and more a part of the solution.

1260 What Air Pollution Does to Your Plants. Palm, E. W. (Crops Soils Mag. 23(4) 1971). The invisible chemicals, such as sulphur dioxide, hydrogen fluoride, ozone, nitrogen dioxide, ethylene, and peroxy acetyl nitrates (PAN) in smog are much more injurious to plants than most of the materials in smoke emissions. The damage that these and other pollutants do to plants often looks very much like the damage done by diseases, insects, and nutritional imbalances. The diagnosis is often complicated because two or more chemicals may work together to increase the injury. Also, plants injured by air pollution will be more susceptible to parasitic diseases. A tabulation is presented of the most common types of air pollution and the kind of plant damage symptoms they cause.

1261 Noise From Industry. Antippa, G. D. (Pollution Control, Sept. 1971). The problems associated with the control of noise in industry are discussed in relation to health hazards and annoyance.

1262 The Stirling Cycle Engine—A Possible Answer to Atmospheric Pollution? Organ, A. J. (Environ. Eng. 50, Sept. 1971). The paper refers to legislation recently introduced in the United States of America to control vehicle exhaust emissions. The nature of the problem of atmospheric pollution by automobiles is briefly reviewed, and the shortcomings of the internal combustion engine identified. Alternative prime movers are examined for suitability as substitutes for the internal combustion engine and attention is focussed on the external combusion class of engine. It is shown that the continuous combustion of hydrocarbon fuels at atmospheric pressure gives rise to remarkably low emissions of carbon monoxide and unburnt hydrocarbons. The Stirling cycle engine is introduced as an externally heated prime mover with many attractive features. In its most familiar form as a constant speed, reciprocating/Rotary engine, however, it is not directly compatible with conventional vehicle transmission systems. The various means of effecting suitabiy rapid variations in output power are summarised therefore, and the idea of a "thermo-hydraulic engine" introduced. It is suggested that, in conjunction with a suitable hydraulic transmission system, such a device could have many practical advantages as a prime mover for road vehicle propulsion, in addition to having exhaust emission characteristics well within emission limits currently in force.

LETTER

The Editor,
Clean Air
Sir,

The turning of the United Kingdom into a 100% clean air, smokeless fuel, zone is hindered by a shortage of smokeless fuel. When coal is burnt on an open fire with a back boiler after the fire is well lit and with the damper open, there is a down draught in front of the boiler, the smoke that is generated passes through the burning zone and is almost all consumed. As the use of coal even in this way sometimes produces a very little smoke it is forbidden in smokeless zones, however, the amount of smoke produced is very small compared with the large amount of smoke produced when coal is burnt in an open fire without a back boiler.

It does not therefore make sense to insist on the use of smokeless coal for down draught burning in one area at the same time as coal is being used in an open fire without a back boiler in an adjacent or other area. Until there is sufficient smokeless fuel for the whole of the country, rather than delay the introduction of new smokeless zones it would make a considerable contribution to clean air to permit the use of coal in the circumstances stated above in at least some but preferably all existing smokeless zones thereby releasing smokeless fuel to be used where coal is now being used in applications that produce very much more smoke.

This would necesitate double stocking, smokeless fuel for lighting the fire and for use in any open fires without back boilers and coal for use in the fire with the back boiler for refuelling but I can assure you that many thousands of householders including myself would be delighted to do this.

Yours faithfully,
J. H. ASBERY

Oakington Manor Drive,
Wembley, Middx.

AIRBORNE PARTICLES

Birds in London's Royal Parks

The 1969-70 report by the Committee on Bird Sanctuaries in the Royal Parks was published in September 1971. It draws attention to the increasing number of birds in Hyde Park and Kensington Gardens, where a record 94 species were seen in 1970. Ninety-four species were also seen in Bushey Park, the highest number for 15 years, while in Osterley Park 97 species were seen, another all-time record. A similar number of species was observed in Richmond Park. The highlight of the period was the establishment in Regent's Park of the first colony of breeding herons in Inner London.

The Romans have been credited with making a number of remarkable discoveries—and although some of the claims appear more remarkable than many of the discoveries—it does seem likely that they were responsible for introducing central heating to this country, some two thousand years ago. They favoured a warm-air system to heat their villas and military establishments and found that wood and coal were the ideal fuels to provide the heat needed to keep their boilers going. Central heating in those days was very much a luxury to be enjoyed only by the ruling class—and their slaves of course! The ordinary man in the via was to remain unaffected by this technological breakthrough for centuries to come. All he had for comfort was a smoky open fire.
Morecambe Guardian. 24.9.71.

All of a sudden more and more people appear to be aware of the pollution problem. Cleaner towns and cities are the forecast for the future. Battersea, though, seems to get grimier every day. One is awakened by the dawn chorus of the birds—coughing. Butterflies stagger past, instead of fluttering by. Dogs, instead of barking, appear to have laryngitis, mice have smog masks and cats have oxygen masks. Even the fleas have fled. To breathe deeply is the dangerous way to live these days.
Letter to South Western Star, Clapham. 17.9.71.

In Times Gone By

Smoke Abatement Nuisance
To the Editor of the Birmingham Daily Post
Sir,—

Sir Oliver Lodge is doing a public service in drawing attention to the smoke nuisance. May I suggest to him that there is no place like Oldbury for studying smoke in all its forms. Green smoke, yellow smoke, black smoke, you will see all the smokes, as many and various as the rats in the town of Hamelin. And if Sir Oliver would be our piper to draw our smokes away, he need not come "pied". All he has to do is to stand in the streets of Oldbury under certain barometric conditions, and I believe he would become "pied" more brightly than the brightest Scotch tartan—at least, our lamp-posts do!
Oldbury, December 16th 1905

Brigitte Bardot, who has a dread of pollution, has left her flat on the Avenue Paul-Doumer and moved into an apartment overlooking the Bois de Boulogne. She feels the purer air there will save her from the scourge. *Daily Mail, 18.10.71.*

INDUSTRIAL NEWS

Road Planing Machines

Following considerable smoke nuisance from road planing and heating operations in the centre of Oxford, which had been declared a Smoke Control Area, Messrs. Amey Asphalt Limited were asked to look into the arrangements for this work in order that, if possible, smoke might be reduced or eliminated altogether from the operations. The firm were known to be interested in progressive improvement of their appliances and eventually acceptable conditions were achieved by the introduction of gas-heating by propane gas as an alternative to the use of diesel fuel where appropriate.

Machines as illustrated may have several funnel outlets over the cowl of the machine or may have a special arrangement involving a gas-fired luminous panel extending over the surface of the road being treated. In this system, as there is no igniting of volatiles, there is no smoke problem. Amey's issue a colour brochure entitled "Heating and Planing" in which interesting examples are given of the type of plant used and the method of carrying out the road works.

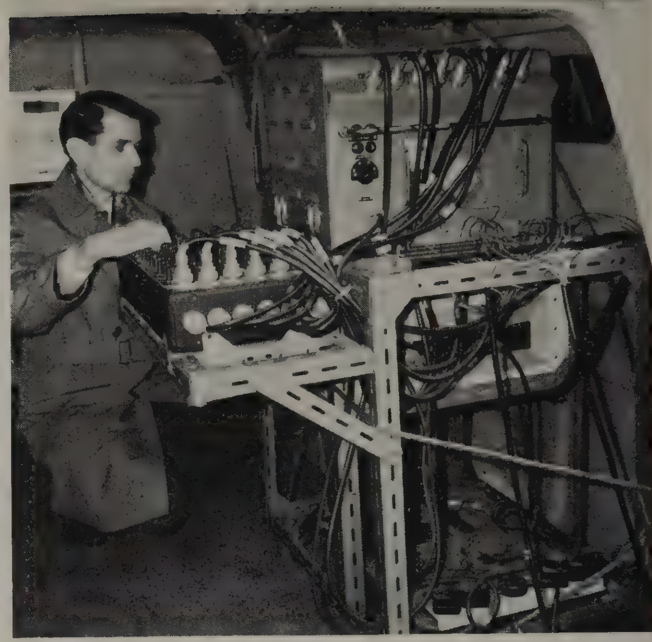
The Company operates two types of machine. One uses a diesel fuel for applying heat by means of a heating cowl; this is a direct flame application to the road surface, but as the fuel is completely atomised, this causes minimum smoke nuisance. The second type of machine utilises a luminous panel which does not provide flame contact with the road surface. Propane gas is the fuel used and, as there is no ignition of volatiles, no smoke pollution is created. This system is slightly more expensive than the oil operated cowl system, but in view of the modern requirements of the Clean Air Act, new machines are being constructed to incorporate this luminous panel heating system. The firm have a programme of modification work in hand to convert existing oil-fired machines to luminous panel heating to avoid smoke nuisance.

A further feature of the activities of this firm is the development of mobile road heating units which enable Local Authorities themselves to heat existing road surfaces where the chippings have been removed, so that new chippings can be applied immediately after heating the surface and rolled into the road immediately. Such a system can save considerable expense as it avoids, in many cases, the complete removal of the wearing surface of the road. It is understood that the firm spends large sums on research involving both United States and Swedish interests, and are continuing their activities in the light of the improvements already made in order that modern treatment can be applied to roads without contravening Clean Air legislation.

The Road Planing Machine

The machine is self-propelled and complies with all Traffic Regulations. It incorporates various units to enable complete maintenance work to be carried out quickly and efficiently with a minimum of inconvenience to road traffic. A burner cowl heats the road surface, after which it may be cut to a controlled depth by a cutting wheel. Material removed is automatically elevated and conveyed to an attendant lorry; and in some cases material saved can be used again. From the operator's cabin, heat can be controlled and applied as needed to meet the requirements of the various types of road surfaces to the degree of softening required. The alternatives of oil or propane gas fuel are available where luminous panel heating is required instead of direct cowl heating.

There is much economical advantage in heating and planing against the removing of road or street surfaces by compressors or other mechanical equipment followed by relaying. In such cases uneven surfaces are left for resurfacing, which can be expensive and at the same time inconvenience traffic to a considerable extent. The heating and planing system utilising the machines described can show a considerable saving of bituminous or tar materials, avoids traffic congestion and permits traffic to use the road immediately after the work had been completed. In addition better rideability is claimed because an even surface is left following the heating and planing operations. It is claimed that heating and planing can result in savings of from 33⅓ to 50 per cent, mainly due to the minimum amount of material necessary in replacing old surfaces with new. Unless the road or street being treated is particularly narrow, traffic diversions during operations can be considerably reduced or averted.



The service includes all equipment and two skilled operators with their own self-contained unit.

Reader Enquiry Service No. **71142**

Redland Bricks Switch Over to Gas Firing

With the conversion of its Holbrook kilns from oil to the Thermo Murg gas firing system Redland Bricks Limited, a member of the Redland Group, is now entering the final stages of a one year changeover programme as a result of the sharp increase in coal and oil prices. At the same time it puts the company among the first of the major brick manufacturers to switch over entirely from conventional fuels of oil and coal.

Redland Bricks, along with the rest of the industry, has for many years recognised the technical advantages of gas as a fuel for brick production but until the advent of natural gas, which brought a downward trend in prices, these advantages were far outweighed by the economic disadvantages and limitations on supply.

Redland immediately took advantage of the new price reductions, particularly that of liquid petroleum butane (LPG), by setting up an extensive research and development programme to determine the viability of using gas as the main fuel for its production.

Initial trials were carried out on two kilns fired by LPG, then more readily available than natural gas. These trials at once proved the soundness of the system and clearly indicated that there would be every advantage in continuing to use LPG for the entire conversion programme.

The Holbrook system

The Thermo Murg top firing system, utilising LPG butane as fuel, installed at Holbrook is typical of the type of conversion carried out during the programme.

In this instance the system replaces the Sabo and Prometheus oil impulse burners originally fitted to the two kilns when the works were inaugurated in 1963. In a number of other works the fuel replaced is coal but the basic system installed remains much the same.

Two identical systems are used for the Holbrook kilns, these being supplied as packaged units, each comprising a fan with connectin ducts and a gas distribution network. Ten distribution units give a firing capability of 20 rows of burners and 57 injectors.

Gas and air are fed separately through the system and each injector is fitted with its own pressure regulator to give variable control. The injectors are also fitted with quick acting gas and air hose connections to allow for rapid removal, and each can be adjusted vertically for the required degree of protrusion into the kiln. The air duct also remains at a constant pressure but the injectors incorporate separate air feeds controlled by regulating dampers.

An important characteristic is the length and temperature of the flame that can be obtained from each of the burners, and to this end a wide range of control can be exercised. The system is broken down into eight subzones within the kiln and the different heats are regulated by indicating temperature controllers signalled from eight duplex thermo-couples installed in the kiln crown which operate gas solenoid valves and air damper motors on each row.

Gas supply to the burners can be regularly adjusted by an on/off control but as it is essential that the injectors be kept cool throughout the burning cycle a constant air flow must be maintained this being modulated between full and half, the allowable minimum for the system.

The entire system operates on a 'fail safe' basis with the overall controls on gas and air pressure being monitored at all times and warnings automatically signalled in the event of failure.

Kiln operation

Each kiln incorporates an exhaust fan, three pre-heating zone re-circulating systems, a hot air fan to supply hot air for the dryer, and an air inlet fan.

Both kilns are designed to hold 42 cars at one time (a total of 84), and these are pushed through by hydraulic rams at the rate of half a car every 56 minutes to provide a 72 hour firing cycle.

Pre-heating is carried out from cars 1 to 17 where the temperature is raised from 450°C to 800°C. The main firing zone commences at car position 18 at which point the Thermo Murg burners begin operating to bring the kiln to its maximum temperature of 1030°C at car position 23. From here the bricks are held at peak temperature for a minimum of 12 hours before being gradually cooled to a temperature of some 40°C at car position 42. As with the Thermo Murg installation, all operations are constantly monitored and recorded by fully automatic control panels.

The liquid butane is stored in a newly built 'tank farm' located alongside the two adjacent works of Warnham. This farm has a capacity of 400 tonnes and supplies the requirements of all three works. The LPG is piped to Holbrook in liquid form where it is converted into a gas by a group of direct-fired vaporisers which are designed to 'cannibalise' some of the gas and use it to fire the vaporiser heaters.

Apart from the economic advantages of gas, the system also enables the brick manufacturer to exercise a far greater degree of control during production, reduces the amount of burner and kiln maintenance required, considerably improves working conditions within the factory, and, above all, leads to a much better quality end product.

Reader Enquiry Service No. **71143**

New Portable Electrostatic Air Sampler

The new Bendix Model 959 Electrostatic Air Sampler is an extremely light, compact and portable unit for the collection of such aerosols as dusts, fumes, smokes and bacteria.

Designed for use in industrial environments, atmospheric pollution studies and radioactive particulate monitoring, the Model 959 consists of a sampler unit, power supply, rechargeable battery, tripod and complete set of spare parts—all contained within a rugged carrying case.

A small fan draws air into the side inlet of the sampler and exhausts it from a port. Between 10 and 14 kV d.c. is applied to a recessed probe centred in the inlet tube. The electrostatic field between probe and tube precipitates airborne particles on the inside of the tube.

The removable inlet tube can itself be used as collector; or paper, foil, or other sheets can be rolled and inserted into the tube. Particulates can also be collected for direct use in subsequent experiments, for example, bacteria may be collected on nutrient-coated paper.

Air flow is varied from 3 to 8 cubic feet per minute by orifices easily inserted in the exhaust port. Flow remains constant during the collection period.

The efficiency of electrostatic collection depends upon the nature and particle size of the material being collected. Efficiencies better than 98 per cent at flows between 3 and 8 cfm have been measured with difficult materials like lead fumes (particle size 0·05 microns), sintered iron dust (less than 1·0 micron) and oil mist (1·0 to 5·0 microns).

Reader Enquiry Service No. **71144**

New Waste Liquor Incinerator

Gibbons Brothers Ltd., part of the Gibbons Dudley Group, is to design and build a Waste Liquor Incinerator designed to destroy 2,500 gallons an hour of gas liquor and 800,000 cubic feet per hour of waste gas produced in a plant process. The liquor contains ammonia compounds and phenols. The gas is of low calorific value and heavily laden with tar fog.

Combustion of the gas takes place in two Gibbons G.B. type high intensity burners each having a net heat release of 52 M Btu/hr. and firing into a horizontal cylindrical chamber 11 ft. dia. × 30 ft. long. Liquor is sprayed through four atomizing nozzles into the chamber which is lined with high alumina fire-bricks and is operating at a temperature between 800° and 1,000°C. The unit accepts wide variations in quantity and composition of the liquor and gas and has provision for supplementary firing of heavy fuel oil if the gas quality becomes too poor to support combustion.

The products of combustion which are free of solids and combustibles are exhausted to atmosphere by a 170 ft. high, refractory lined, self-supported chimney.

The incinerator has a comprehensive automatic electronic control system which enables the wide variations in flow and composition of the gas and liquor to be accommodated within the design limits. The desired air/fuel gas ratio is obtained by means of an automatic ratio controller linked to the gas flow. The system also embodies fully automatic protection against hish and low temperature conditions, as well as flame failure should the gas quality fall too low, and the incinerator can run unattended for long periods.

Reader Enquiry Service No. **71145**

Extra High Output Central Heater Burns Bituminous Fuels

With the launch of their Coalmaster, Radiation Parkray Limited offer an extra high output unit designed to burn cheap bituminous single sized fuels virtually smokelessly.

The 11·6 kW (40,000 Btu/h) Coalmaster will provide living room heat, all domestic hot water and feed up to eight radiators from one elegant, glass-fronted unit. If it is used for space and radiator heating only, it will heat up to nine radiators and a towel rail.

Background

The Coalmaster was developed by Parkray design and development engineers based on work undertaken by the National Coal Board on the general principle of smokeless combustion of bituminous coal.

The N.C.B. produces large quantities of the selected small bituminous coal suitable for this appliance. This will be marketed under the trade name "Housewarm" and will be made available progressively in all parts of the country except for South Wales and the North East coast. The Coalmaster burns Housewarm smokelessly, and exemption under the Clean Air Act by the Ministry of the Environment is expected shortly so that the appliance could be installed in smoke control zones where it will qualify for grant.

Reader Enquiry Service No. **71146**

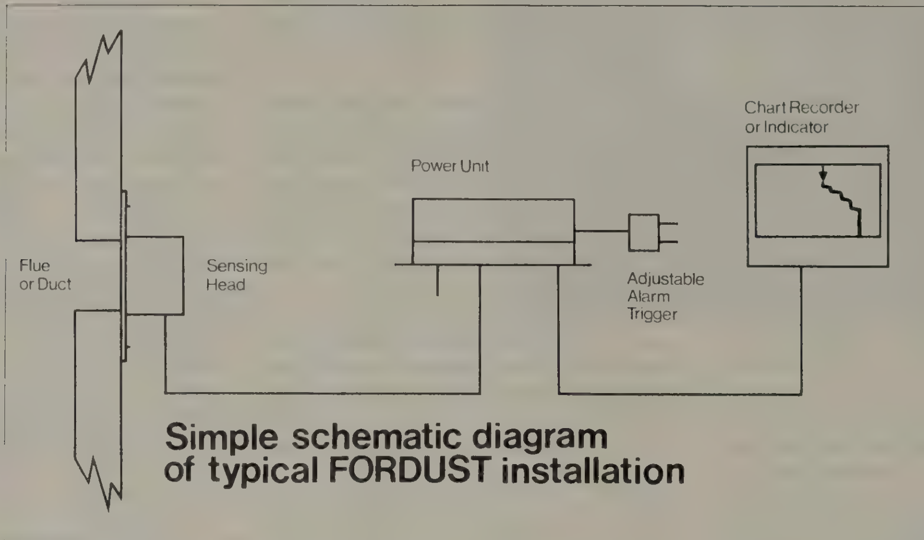
British Incinerators for Russia

We have been asked to make it clear that the two chemical waste incinerators recently commissioned in Russia by The Incinerator Company Limited, were both designed by that company and not by any member of the Consortium as implied in the statement in the last issue of *Clean Air*.

Fordust—a new development in Smoke and Dust Monitoring

This new system, which is based on the experience gained with earlier systems, has been developed in close collaboration with the North West Region of The Central Electricity Generating Board, for whom a large number of systems are now installed or in production.

As the pollution level rises, this reflection, or ' back-scatter ' increases in intensity and is detected by a sensing unit. By using this ' back-scatter ' principle, Wesglade have been able to combine the stabilized light source, and the sensing element, in a single unit. This means that only a single aperture is required in the duct, and that the alignment problems encountered with two-aperture "interference" systems are completely eliminated. The Fordust sensing unit is extremely sensitive, and is suitable for use in very large ducts.



Simple schematic diagram of typical FORDUST installation

Fordust is designed to give early warning of smoke and dust alarm conditions, measured against predetermined pollution levels. In practice the system can be arranged to give warning of a rise in pollution levels before critical levels are reached.

The system works by projecting, into a flue or duct, a stabilized light source. Dust and smoke in the duct cause a degree of reflection of this light.

Alarm conditions can be indicated in a number of ways, audibly, visually or by means of a permanent recorder, and, if required, these indicator units can be mounted at a remote location. The basic Fordust system consists of only two units, the Sensing Head (comprising both light source and light-sensitive cell) and a steel enclosure containing the chassis, power supply assembly and electronics assembly. This enclosure is damp proof and dust proof and measures 150 mm × 240 mm × 365 mm.

Installation of the system is quick and simple and, once set, the only maintenance required is the routine cleaning of the lenses in the sensing head, which can be completed in minutes.

In extensive tests in C.E.G.B. installations the Fordust system has demonstrated a high degree of sensitivity and reliability. Units are now available, or under development for applications in all types of boiler systems, and any other location or process in which any type of smoke, dust or other pollution hazard is generated.

Reader Enquiry Service No. **71147**

Polar Panorin

One of the major air pollution problems is the emission of acidic soot particles from oil-fired boilers. Acidic smutting is caused by formations of unburned carbon acting as the vehicle in which sulphuric acid condenses as the soot particles leave the chimney and come into contact with the cold air outside. pH values as low as 0·5 are common and the effect of these acid-loaded smuts landing on cars, washing, paintwork, stonework, etc., can be ruinous. Many industrial boiler operators have had to pay for the damage caused. It is claimed that Polar Panorin can eliminate acidic smutting and reduce the need for soot-blowing (a major cause of smutting) very considerably.

Polar Panorin is a very powerful oxidising agent. When injected directly into a working boiler Polar Panorin immediately starts to oxidise unburned carbon throughout the combustion-side of the boiler system. In this simple way the vehicle for the sulphuric acid is removed. In addition, the chemical reaction which takes place results in the formation of alkaline salts which help to increase pH values throughout the boiler and therefore corrosion is reduced.

The cost of using Polar Panorin is more than off-set because the oxidation of carbon greatly improves the heat-transfer rates throughout the boiler and therefore reduces fuel consumption and the frequency of soot-blowing and manual cleaning. Average operational cost savings in the order of 5 per cent are claimed and substantiated by many industrial and marine users.

Reader Enquiry Service No. **71148**

Air Filter Selection Guide

AAF-Ltd. have published a new Air Filter Selection Guide. Included in this they have introduced to the Heating and Ventilating Industry a totally new concept, "The Owner Benefit Index". This index combines all selection procedure advice and reveals the total air filter performance over the life of the product. Major features of the index are efficiency and owning and operating costs.

Activated-Carbon Filters Prevent Diesel-Fume Nuisance in Air-Conditioned Offices

With no increase in size and no reduction in its original efficiency, a sophisticated air-conditioning system has been adapted to prevent the smell of diesel fumes creating unpleasant working conditions for key personnel in a major car plant. Thirty CF-4 activated-carbon filter units made and supplied by GKN Farr Filtration Limited have been installed in the air-conditioning system of a three-storey office building at The Rover Company Limited, Solihull, to prevent the smell of these fumes reaching the offices. Since the carbon filters were installed, not only has this odour not recurred but other objectionable odours have been reduced.

This modern three-year-old office building, housing engineering staff concerned with vehicle design and production, is double-glazed with no opening windows and is designed to provide a congenial and healthy working atmosphere at all times. All heating, ventilating and humidity requirements are monitored and supplied as necessary by a sophisticated 60,000 $ft.^3$/min. air-conditioning system.

From the time the building was first occupied, reports were received periodically of an occasional 'diesel'-type odour inside the building. The air-conditioning system itself was checked and it was established that this was not the source. Diesel engines associated with heat exchangers located some distance from the offices were eventually blamed—until the odour recurred on a day when all these diesels were shut down. It was finally discovered that the source was the idling engines of diesel-powered lorries waiting to enter a nearby loading bay.

As the source cannot be removed the system was examined to find a means of avoiding the intake of fume-laden air. Consideration was given to re-positioning the air intakes but this would have involved considerable expense, spoiled the lines of the building architecturally and (most important of all) could not be guaranteed effective under all circumstances. The How Group Midlands Ltd.—installers of the original system—recommended that the installation of activated-carbon filters with glass-fibre pre-filters would provide the most effective and economic solution.

Since its installation in August 1971 this particular solution has also brought with it a special advantage. A variable but frequently high percentage of the 60,000 $ft.^3$/min. of air used in the system is recirculated, picking up and carrying with it internally generated odours such as that from tobacco smoke. The use of carbon filters has considerably reduced these as well as eliminating the smell of diesel fumes.

To avoid altering the layout of the air-conditioning system, the carbon filters (with pre-filters) have replaced the bag filters originally installed. Each carbon filter unit is designed to accommodate dust-filters, and, to maintain a dust filtration capability similar to the original bag filter system, compact disposable glass-fibre pad media pre-filters have been installed at the inlet end of the new installation. These are GKN Farr Filtration type d.c. filters capable of removing 90 per cent of airborne particles of 10-microns size or more.

Adsorbtion by activated carbon is a long-established method of trapping odours. Odours are either gases or vapours and will condense on any surface, and it is estimated that the porous structure of a pound of activated carbon—about 50 $in.^3$—contains approximately 6,000 000 $ft.^2$ of surface area. The carbon used by GKN Farr Filtration can adsorb up to 50 per cent of its weight with odours and retain them in its vast network of fine pores.

The GKN Farr Filtration CF-4 carbon filter is a high-velocity straight-through complete purification system as distinct from the partial by-pass type more commonly used.

Each CF-4 filter unit consists of a strong heat- and corrosion-resistant metal housing containing 12 individual polystyrene-frame cells with similar properties. The cells are installed in a multiple V-pattern to offer the maximum filtering area in a limited duct space. Each cell holds 7½ lb. of high-quality activated carbon granules.

Reader Enquiry Service No. **71149**

£30,000 Order for Mikropul

Dust extraction equipment to the value of £30,000 has been ordered from Mikropul Ltd., by Cleveland Potash Limited for their mine at Boulby, North Yorkshire.

Eight schemes comprise primary cyclones followed by Mikro-Airetron Venturi Scrubbers complete with exhaust fans, recirculation scrubbing liquor pumps and tanks.

All schemes will eliminate dust problems at the conveyor and chute transfer points on the raw material side of the process plant.

Reader Enquiry Service No. **71150**

Sheffield Wire Mills Handle Pollution Problem

One of Britain's biggest independent producers of stainless steel and alloy wire, Arthur Lee & Sons Limited, of Sheffield, have just completed a fume cleaning project to deal with the risk of air pollution caused by increased output from the wire cleaning section of their Bessemer Road plant.

The growing demand for larger coils of wire has involved the installation of much bigger pickling tanks. These handle hydrofluoric/nitric and hydrochloric acids. To deal with the increased volume of fumes from the plant a 16,000 c.f.m. exhaust system was needed. The all-plastics system was designed in association with engineers of Plastic Constructions Limited, who were also responsible for its fabrication and installation on site.

The first part of the work, consisting of the erection of a line of 7 ft. 6 in. extract hoods over the pickling tanks, had to be undertaken in one week during the annual shutdown in early July. From design to commissioning the whole contract took only five weeks.

The gases from the process are drawn through a 16,000 c.f.m. Placon 'C' type fume scrubber. They are carried on a spiral course through several stages of blades and deflectors. Large wetted surfaces and water curtains in the scrubber absorb the acid particles. An alkaline solution is circulated through a spray cone, and a mist eliminator is fitted to prevent moisture carry-over.

The lip-extraction hoods on the pickling tanks are fabricated from 3/16 in. thick rigid PVC externally reinforced with polyester resin glass-fibre laminate. The ducting from the offtakes to the fan and from there to the external discharge system is also reinforced PVC.

Powering the system is a 28½ in. V-belt 'Placon' fan. The use of standard items of equipment greatly assisted the task of planning the operation for completion in so short a time. The installation work included building a special platform behind the mill where it backs on to the River Don to enable the fume scrubber to be cantilevered over the river level. Total cost was about £6,000.

Reader Enquiry Service No. **71151**

New Design Laminar Flow Clean Air Cabinets

W.H.S. (Pathfinder) Ltd. are leading exponents of critical atmosphere control and specialize in laminar flow clean-air techniques.

One of their standard products has, for several years, been a range of self-contained clean air cabinets; and these cabinets are in use in the electronics, aircraft components, data processing, chemical, food processing and precision engineering industries as well as in hospitals and research laboratories. These cabinets are already in use in 22 countries throughout the world.

Now, a new range of clean air cabinets has been designed which retains all the advantages of the earlier range but has many new features and user advantages.

Advantage No. 1 is that the new range of cabinets cost less; with no reduction in quality or performance. Modular design ensures ease of handling, rapid build-up or dismantling, easy passage through standard doorways, and by use of add-on units allows low-cost modification *in situ*. Bench mounted models, free-standing cabinets, vertical or horizontal flow types are available.

Low noise level operation and good access, whether sitting or standing, keeps operators happy and more productive. Guaranteed leak-free filters are used and all units are fully tested prior to despatch and issued with a test certificate to U.S. Federal Standard 209A. This standard for clean air equipment is universally recognised and Pathfinder Laminar Flow Cabinets perform in excess of this standard to ensure localized atmospheric conditions completely free from dust particles or bacteria.

Reader Enquiry Service No. **71152**

Pollution Control by Television

Every month an average of 18 tons of dirt and soot falls on each square mile of the United Kingdom. This is pollution; a problem that technologists must solve in the near future if we are not permanently to harm the animal and vegetable life on our planet.

The Central Electricity Generating Board is aware of the significance and increasing importance of pollution control and, like many other industrial concerns, is doing its utmost to prevent any dark smoke emission from its chimneys. With this in mind it has just added another weapon to its armoury of pollution control—Photo-Scan closed-circuit television.

This is now installed at C.E.G.B. Tilbury A and Tilbury B power stations in Essex to monitor the smoke emitted from their 360 and 500 foot high stacks.

Cameras positioned in weatherproof housings keep a constant eye on the tops of the chimneys and relay live pictures back to monitor screens situated in the power station's respective control rooms. This is believed to be one of the first installations of its kind in the country.

According to the assistant instrument engineer at Tilbury, Mr. H. Bentley, the CCTV system is performing its function very satisfactorily, and although the power station has additional smoke density instruments in operation, these sometimes let them down. So the Photo-Scan system supplies a reliable back-up.

Mr. Peter Goddard, managing director of Photo-Scan (London) Ltd., who supplied the system, says: "We believe that this type of installation has much potential in the field of pollution monitoring and control. In fact, the C.E.G.B. is now seriously considering further such installations at other power stations around the country."

The next C.E.G.B. Photo-Scan pollution monitoring system is planned for installation next month at the Brunswick Wharf power station situated on the Thames. As at the Tilbury installations the cameras will be focused on the stack tops to warn the control room of the emission of smut-laden smoke.

New Gas Council Chairman

Arthur Hetherington, the present Deputy Chairman of the Gas Council, is to take over as Chairman on 1 January 1972, on the retirement of Sir Henry Jones, who has led the industry for the past 12 years.

Mr. Arthur F. Hetherington, D.S.C., B.A., C.Eng., F.I.Gas E., has worked in the gas industry since 1935 when he joined the Gas Light and Coke Company. During the war he served with the Fleet Air Arm. After the war he returned to the Gas Light and Coke Company and in 1949 was appointed Manager of the Central Division of the North Thames Gas Board.

In 1955 he was appointed Commercial Manager of the Southern Gas Board. A year later he became Deputy Chairman of the Board and then in 1961 Chairman.

Arthur Hetherington, D.S.C.

In May 1964 he was appointed Chairman of the East Midlands Gas Board, where he stayed until his appointment as Deputy Chairman of the Gas Council in 1967, in which capacity he was largely responsible for the North Sea gas negotiations and the reorganization of the Council.

Mr. D. E. Rooke, C.B.E., will take over the position of Deputy Chairman from Mr. Hetherington on 1 January 1972. He has been with the Gas Council for 11 years.

Official Opening of Birmingham Incineration Plant

Birmingham's new refuse disposal works at Perry Barr, for which the principal plant contractors were Head Wrightson of Teesside, was officially opened on Wednesday, 22 September. The ceremony was performed by Mr. Graham Page M.P., Minister for Local Government and Development.

Head Wrightson's contract covered the supply and erection of all the mechanical and electrical plant required for the disposal of refuse at the rate of 24 tons per hour. It included twin incinerator grates with the unique reciprocating action which Head Wrightson manufacture to the designs of Josef Martin of Munich; equipment to clean the gases and control dust and grit; mechanical handling equipment for every stage in the operation, and a 300 ft. high chimney stack to exhaust the clean waste gases to the atmosphere.

Building and civil engineering work was carried out by Holland Hannen and Cubitts (Midland) Limited of Solihull, who have provided a not only functional but also aesthetically pleasing building to house the plant.

The Birmingham plant is the second to be completed by Head Wrightson Process Engineering Limited, following the 8·3 tons per hour plant now successfully operating at Exeter. They have also undertaken contracts for plants, capable of handling 24 and 36 tons per hour respectively, for the cities of Nottingham and Coventry.

Reader Enquiry Service No. **71153**

Major Pollution Study for Greater Manchester

What types of wastes are created in the Greater Manchester Area? In what quantities? Just how are they disposed of—in the atmosphere, in rivers, on land or at sea? What are the pollution problems of the future going to be and how will they affect our environment?

As part of a £60,000 two-year research programme the university's Pollution Research Unit is trying to find the answers to these questions by making a close study of pollution in the Greater Manchester Area. It is the first study of its kind to be made.

The unit's job is to advise the Science and Social Science Research Councils on pollution problems, especially by forecasting future levels and their effects. Dr. Norman Lee, the Director of the Unit, believes that a study of the pollution from various sources within a particular area will help him and his team to make forecasts. The immediate area, which is affected by so many types of pollution is obviously a good place to start.

The first aim of the study is to find out what kinds of wastes there are here, their quantities, and how they are disposed of. Are they directed into the air, channelled into water, dumped on land or what?

This information will then be used as a basis both for forecasting the future levels of wastes likely to occur in the area and the effect they may have on the regional environment.

The study will be co-ordinated by Mr. Christopher Wood, 27-year-old chemist and town planner within the Unit, and he will be assisted by four other members of the research team. It is expected that the project will take about a year to complete. It will involve the co-operation of the various authorities within the area, who have responsibilities for controlling pollution, and the active assistance of industrialists in the vicinity.

Reader Enquiry Service No. **71154**

Decatox Process Kills Smells at Animal Waste Product Plant

The Decatox system, developed in West Germany for the removal of obnoxious and toxic elements from industrial waste gases, is now finding applications in this country.

One of the first companies to use the Decatox system in Britain is Chettles, Feather and Hair Products Limited of Wymington, who steam-cook feathers and intestines from chickens to obtain proteins for animal feedstuffs. The hot and rather strong-smelling vapours from the cooking process are passed into a chamber where they are mixed with hot air and brought to a reaction temperature of about 350°C. They are then drawn through a catalyst bed where a reaction takes place causing their complete oxidation and breakdown to simple gases—CO_2, water vapour and nitrogen—which are all odourless.

These gases, while still hot, are used for pre-heating the incoming contaminated gases and are then passed through a fan and exhausted into the atmosphere.

Decatox plant is available in standard sizes to cover normal capabilities from 500 to 15,000 cubic metres per hour. Larger equipment can be supplied if needed.

The Decatox process is marketed in this country by Bush Beach Engineering Ltd.

Reader Enquiry Service No. **71155**

INTRODUCING NEW MEMBERS

Mass Transfer Ltd.

Mass Transfer Ltd are manufacturers of dust and fume removal equipment. Their equipment includes the "Cascade Dustractor" tray which cuts costs in a variety of gas cleaning systems. They also have an exceptionally wide range of tower packings, used throughout the world in gas absorption, gas cleaning and other gas/liquid systems. Mass Transfer Ltd also have a consultancy service in this field.

Reader Enquiry Service No. **71156**

P. G. W. Hawksley Esq., Process Development Associates

The organisation, Process Development Associates, has been formed by Mr. P. G. W. Hawksley, formally of BCURA. The service supplied by this new company includes on-site testing which is undertaken by a skilled team, using the appropriate indicating or recording equipment, who report and interpret the results in plant terms. A wide variety of specialised measuring techniques are available including sampling for solids concentration and gas composition, continuous recording of O_2 percentage in discharge gases from combustion systems etc.

Reader Enquiry Service No. **71157**

SF Air Treatment Ltd.

SF Air Treatment Ltd are a member of the Swedish International Group. They are manufacturers of all forms of air treatment equipment concerned with industrial air treatment and ventilation, comfort air conditioning, and marine air conditioning. The range of standard products for general ventilation applications would include packaged air handling units, prefabricated plant rooms, cooling towers, fans, filters, heat exchangers, humidifiers, silencers etc.

Reader Enquiry Service No. **71158**

CLEAN AIR SPRING SEMINAR 1972

22nd and 23rd March 1972
The Grand Hotel
MANCHESTER

SESSIONAL PROGRAMME

Wed 22 March	**Disposal of Wastes**	
09.30	Industrial Waste—The Problem of Disposal.	N. Iliff (Shell Chemicals).
	Incineration	
	(i) On Site.	K. Dunn (Incinerator Co.).
	(ii) Centralised.	W. A. Clennell and C. R. Mowle (Motherwell Bridge Tacol Ltd.)
	Coffee Break.	
	(iii) Rubber and Plastics Wastes.	G. Cheater (Rubber and Plastics Research Association).
	(iv) Sewage sludge.	G. Moodie (Head Wrightson & Co.)
	Discussion.	
12.45 for 13.00	Luncheon.	
	The Working Environment	
14.30	Integrated Environmental Design.	H. G. Mitchell (The Electricity Council).
	The Role of the Heating, Ventilating and Air Conditioning Engineer in Pollution Control.	F. M. H. Taylor (I.H.V.E. Study Group).
	Dust Extraction.	P. Swift (Dust Control Equipment Ltd.)
	Clean Rooms.	R. B. Williamson (W.H.S. Pathfinder Ltd.)
	Afternoon Tea.	
	Discussion.	
Thur 23 March	**Grit, Dust and Gaseous Pollutants**	
09.15	A Practical Approach to The Statutory Control of Emissions.	C. R. Creswell (West Bromwich C.B.)
	Dust produced by non-Combustion Processes, its Effects and Control.	C. D. Darley (Birkenhead C.B.)
	High Efficiency Gas Cleaning.	K. Darby (Lodge Cottrell Ltd.)
	Desulphurisation of Flue Gases.	J. Bettelheim (CEGB).
	Coffee Break.	
	Electrostatic Precipitators.	A. J. Moyes and M. Swift (W. C. Holmes & Co. Ltd.)
	Discussion.	
12.30 for 12.45	Luncheon.	
	Furnaces and Chimneys	
14.15	Boiler Furnace Design Considerations for Dual Fuel Firing.	H. B. Weston (NIFES, Northern Area).
	Trends in Modern Chimney Design.	M. Beaumont (F. E. Beaumont Ltd.)
	Progress in Automatic Control.	R. P. Braby (Honeywell Ltd).
	Discussion.	
16.30	Seminar Ends.	
	Afternoon Tea.	

Registration Fee £18.50 which will include copies of all Papers and Report of Proceedings, coffee, luncheon and tea on both days.

National Society for Clean Air, 134/137 North Street, Brighton BN1 1RG.

SPRING SEMINAR **** 22–23 March 1972.

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SPRING 1972
VOL. 1 NO. 5

PRINCIPAL CONTENTS

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

Vol. 1 No. 5 **Spring 1972**

Principal Contents

Index to Advertisers

CLEAN AIR is published quarterly by the National Society for Clean Air at 134/137 North Street, Brighton BN1 1RG. Tel: Brighton 26313.

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"This most excellent canopy, the air"

CLEAN AIR

Survival or ?

"The principal defect of the industrial way of life with its ethos of expansion is that it is not sustainable. Its termination within the lifetime of someone born today is inevitable—unless it continues to be sustained for a while longer by an entrenched minority at the cost of imposing great suffering on the rest of mankind." The "Blueprint for Survival" declaration, supported by Sir Frank Fraser Darling, Sir Julian Huxley and 31 other distinguished scientists and conservationists, and published in the January number of "The Ecologist", certainly gives food for thought if nothing else—and it has certainly caused a stir. Every member of this Society should read it for themselves; although they may not be able to agree with everything that is said, they will certainly be able to go along with some of the statements.

Most people will agree that it is becoming urgent that we stabilise world population; that the population explosion is one of the major factors—if not the major factor—for some of our present ecological and environmental troubles; and that the conservation and recycling of resources is becoming essential.

However, whatever may be our opinions, there is no doubt that the "Blueprint for Survival" does make it clear that there is a necessity for a fundamental rethinking about the world and the exponential growth of technology.

The Spring Seminar

On the 22nd and 23rd March next the Society is holding a Clean Air Spring Seminar at the Grand Hotel, Manchester.

This two day seminar, which will be of a technical nature, will be opened by the Lord Mayor of Manchester at 09.30 on Wednesday, 22nd March and will consist of four sessions. The first session will consider the disposal of wastes; the second will discuss the working environment; the third session will deal with grit, dust and gaseous pollutants, and the final session will be concerned with furnaces and chimneys.

The promotion of a seminar of this nature is a new departure for the Society, but we are very happy to say that we have been fortunate to obtain some very good speakers, many of whom are from industry, and the support for the seminar is most encouraging. So much so that we are already making plans for a Spring Seminar next year, and this will be a residential one at St. Hilda's College, Oxford on the 3rd and 4th April 1973.

Pollution from Road Vehicles

It is well known to all our readers that the Society has for many years been campaigning for the introduction of legislation to control pollution from road vehicles. The attitude of the Society has been that although it accepts, in the present state of knowledge, that the pollution from road vehicles does not present a danger to health, it is an offence against amenity. At the same time it has been pointed out that though the present levels of pollution may not be injurious to health, it is known that the vehicle population is increasing very rapidly and that by 1980 the present level of 14 million vehicles will have risen to about 22 million. In that time, therefore, pollution is bound to increase and if this is to be curbed, action should be taken now. The Society has never taken the standpoint that savage legislation similar to that in force and about to come into force in the United States is required in this country, but have asked that inexpensive and reasonable controls should be applied. Indeed, we have sought to show that much can be done with the use of a properly adjusted carburettor in a well-tuned car. The results of tests carried out by the Society, which are published later in this issue, bear this out.

However, at the time of writing, Mr. Peter Walker, the Secretary of State for the Environment has announced that he has almost completed his review of pollution from motor vehicles and will shortly be making an announcement. When questioned by Mr. McNair-Wilson whether the expected legislation would be binding on vehicles other than new ones, Mr. Walker replied that the government were carrying out research as quickly as possible on the question of a filter of a type that could be fitted to all vehicles, but he agreed that the other regulations which might be made governing the future construction of engines might not be applicable to existing vehicles.

In the past, the Society has never really supported the idea of the introduction of "bolt-on" devices such as filters which are apt to wear out quickly, which can be expensive and are not very efficient. However, recent reports indicate that an efficient and cheap filter may well be available shortly. If such a filter can be fitted to existing vehicles which will serve to reduce pollution to acceptable levels, we can only welcome it. But we welcome even more Mr. Walker's suggestion that other regulations which might be introduced would apply to new construction vehicles and would affect the construction of the engine itself.

Clean Air in Tunnels

by

T. Henry Turner

Guaranteeing continuous provision of breathable air in tunnels, mines, underground housing, works and refuges, raises many awkward problems. How big are they, and how can they be solved?

If the English Channel Tunnel is built, clean air will have to be provided, day and night, year in and year out, without fail, for thousands of staff and passengers. Final plans for boring the chalk between Dover and Calais are still not settled, despite the 1967 British and French Governments' agreement. It was then thought that construction would start in 1969 with 20 miles underwater and 40 miles from terminal to terminal. Engine fumes would be made less than in other existing vehicular tunnels by transporting all road vehicles on special electrically hauled railway flat cars.

Vehicular Tunnels

On the far side of the world twin tunnels are now under construction from Hong Kong to the Mainland. When finished in 1972, the 22 feet wide, mile long, under-water carriage ways will be able to take 70,000 vehicles daily, including double decker buses, and most of the 700,000 commuters and vast quantities of goods that are now ferried daily through a very congested harbour.

In the U.S.A. alone there are at least fifteen under-water vehicular tunnels, all over 1,000 feet in length. The three best known serve New York: Brooklyn–Battery, 9,117 feet long under East River; Holland Tunnel, 8,557 feet long and Lincoln Tunnel, 8,216 feet long, both under Hudson River.

Similarly the U.S.A. has some twenty-six land vehicular tunnels, all over 1,500 feet long. One of them, at Copperfield, Utah, is nearly 7,000 feet long: half a dozen of them 5,000 feet in length.

In the Alps, long vehicular tunnels have been brought into use during the past decade. Between Italy and Switzerland the Great St. Bernard Tunnel has two lanes 24½ feet wide, 14 feet 9 inches high, and 3.4 miles long. It was opened in March 1964 and lies some 6,000 feet above sea level. Still longer is the Mont Blanc Tunnel opened in July 1965, between France and Italy.

Railway Tunnels

The European Alps can also claim the longest railway tunnel in the world, the Simplon Tunnel, 12.3 miles long, between Switzerland and Italy. Its first tube was completed in 1905, its second tube in 1922.

In Britain our longest railway tunnel is that under the River Severn: it is 4 miles 628 yards long. In the list of our tunnels there are three more over three miles long and five more over two miles long. Because railways were pioneered in this country and others could benefit from that early experience, our tunnels are lower and narrower than many abroad.

Consequently, when the early primitive steam engines first came to haul trains through British tunnels, air pollution had arrived at its worst. The smoke, moist, sulphurous exhaust from the steam engines rapidly corroded away the iron and steel fittings and running rails, fouled all vehicles, and nearly choked train crews, track maintenance men, and paying passengers. So thick was the smoke in some railway tunnels that it even deadened the sound of approaching but quite invisible locomotives, thus adding to the peril of those working in the tunnel. Even forty years ago I had to be warned to watch the flame of my hurricane lamp, when ever I walked in some long tunnels during my inspections. "You will not hear the train coming, in time to avoid it; so if it's advancing compression of the air in front of it makes the flame of your lamp flicker, hurry into the nearest tunnel wall refuge cavity."

Compared with some of the really mountainous countries Britain seems to be merely hilly. Hence we note that the following much longer railway tunnels exist abroad:

Italy —Appenine Tunnel, 11 miles 880 yards, and the Mont Cenis Tunnel, 8 miles 870 yards long.

U.S.A. —Cascade Tunnel, 7 miles 1,410 yards long.

Japan —Shimizu Tunnel, 6 miles 70 yards long.

Early steam railway engineers tried to calculate the volume of fresh air they would need to ventilate their tunnels, from the consumption of coal by the locomotives during passage and the potentially poisonous gases that consumption produced. They aimed at a standard of purity of 20 parts of carbon dioxide in 10,000 parts of air. Experience showed, however, that ventilation of steam railway tunnels is a much more complicated matter than one would expect. Natural ventilation may give an upward draft in winter and downwards draft in summer. Either may be completely upset by normal changes in wind speeds and directions. In spring and autumn, when there is little difference in temperature, there are long periods of little circulation of ventilating air.

Mechanical fan ventilation was first applied to a railway tunnel in the Lime Street, Liverpool, tunnel of the London and North Western Railway. This tunnel was later opened out into a cutting but fans were applied to the Severn and Mersey railway tunnels.

Urban Underground Railways

There are approximately 100 miles of railway tunnels under London. Depending upon the nature of the sand, clay or rock sub-soil, and the proximity of streams, rivers, hills and valleys, the constructors of underground railways have chosen either subways or tubes.

The London Metropolitan and District lines are laid in shallow, sub-surface tunnels, as was the more recent four track, main line railway passing under Brussels. There, over the years, Belgian engineers showed me vast trenches cut through housing areas and parks. Concreted, roofed over, and covered by a modern motor way, this sub-surface line permits the centre of Brussels to have a main line passenger station on the France/Netherlands through route.

London's first tube, from the Bank to Stockwell, part of the present Northern Line, was begun in 1886 and completed in 1900. Tunnels of the Morden–East Finchley line alone were said to extend for $17\frac{1}{2}$ miles. The latest very useful addition to London's underground system is the automated Victoria Line, which is still being extended southwards.

Abroad, one may note that in Paris their first underground railway was built in 1898 and their system has grown extensively. Long sections of the rapid transit system beneath the streets of New York have also been built in tunnels although they also had an elevated railway. More recently, urban underground railways have been built in Moscow, Warsaw and Milan. Initial cost of such urban underground tunnel railways may seem fabulously high, but the increasing congestion and air pollution in city streets makes many of the world's largest cities regard clean, quick, electrically driven underground passenger transport as essential.

Risks in Tunnel Building, Maintenance and Use

When a tunnel is to be constructed the risks to its builders must be minimised. Also, it must be remembered that once construction is finished men must continue to work in it to maintain its fabric, lighting, track, walkways, drainage, ventilation and signalling.

Experience in ancient times

Mankind has a surprisingly long and varied experience of providing breathable air to men underground in tunnels. Tunnel making was one of the earliest works undertaken by man, for his dwellings, tombs, quarrying, mining, and later for water supply and drainage. One reads of very long tunnels driven for the tomb of Mineptah at Thebes, underground quarrying opposite the pyramids of Egypt; and wherever the Romans went remains of tunnels for roads, drains, and water supply are found.

An outstanding example of Roman tunnelling was the 3.5 mile long tunnel driven under Monte Salviano for drainage of Lake Fucino. In those days of slave labour, pickaxes or hammer and chisel, crude ventilation by shaking cloths was aided by inclined boards fixed at the top of the shafts. Its construction needed 40 shafts, no less than 400 feet in depth, and some inclined galleries. Up these was drawn the excavated material by windlasses, and 30,000 labourers took 11 years to make it.

Tunnelling in War

Tunnelling under the stone walls of towns or castles was a primitive form of warfare employed for many centuries. It was still employed in 1683 when the Turks besieged Vienna. For three months before they were finally routed they burrowed tunnel after tunnel under Vienna's western defences, and blew them up bit by bit. Although they had come from the east the Turks attacked from the west because they could not use their tunnelling method of destroying stone walls on the eastern side on account of the wetness of the ground near the Danube River.

As recently as the 1914–1918 War, on the Western Front, the same methods were used; both sides employed miners to tunnel under the opposite entrenchments, and blow them up.

But in *peacetime tunnelling* during the recent centuries explosives have replaced much of the primitive pickaxe, hammer and chisel work, and many tunnels were built for canals. When railways came to replace canals, tunnelling was already an everyday job for contractors in their building of approximately 4,000 railway tunnels.

Looking back one sees that railway tunnels followed tunnels on the extensive canal system. They followed the canals that miners had burrowed into hills for the transport of what they excavated from deep under the hill to the open air exit.

The ancient miners devised crude fans or other air moving apparatus to send fresh air to those below, as they toiled to extract the ores of tin, lead, copper, gold, or other metals, coals, fire clays, rock salt, and other such wanted minerals.

Working down such mines men, women and children contracted lung diseases from dusts, as do quarrymen above ground, but miners also risked asphyxiation by mine damp, explosive methane or dust mixtures with air, cramp from loss of salt through excessive perspiration, and rheumatism from mine waters dripping all around them. They survived only if they devised some control of their abnormal environment.

Clean Air for the Channel Tunnel

Responsibility for planning the English Channel Tunnel is shared by both the British and the French Governments and the many contractors who may become involved.

For all of those involved "*Air Pollution Abstracts*" issued monthly by the Warren Spring Laboratory, Stevenage, and the "*Clean Air Yearbook* 1970–1971" issued by the National Society for Clean Air, Brighton, should be essential reading

The Yearbook lists, by courtesy of the Interdepartmental Committee on Air Pollution, all U.K. air pollution research known to be in progress in 1969, partly or wholly funded by the Government, and also some similar industrial researches. That is welcome because since metal smelting and forging developed many smith's fires have added industrial air pollution to the chimneyless fires, for warmth and cooking, that blackened primitive cave dwellings, nomads tents, mud daubed huts and even imposing castles.

The Technical Committee of the National Society for Clean Air has for many years given much study to air pollution from road vehicles. If road vehicles were allowed to use their own engines in the tunnel, carbon dioxide, treacherous carbon monoxide, lead from petrol, and nitrogen oxides from diesel engines, and even asbestos debris from brake shoes and rubber debris from tyres would need consideration in the confined conditions of the tunnel.

Blackwall and Rotherhithe vehicular tunnels under the River Thames have been notably improved during recent years. The Greater London Council Scientific Branch's Annual Report 1969 deals with their weekly tests of the ventilation of both these tunnels during the past forty years. Welcome news is that the ventilation has been greatly improved although the traffic using these under river tunnels has greatly increased.

The Safety in Mines Research Establishment has done much research work on the sampling and analysis of dusts, mainly by working in coal and rock.

The National Coal Board's *Institute of Occupational Medicine* has studied the relationship between respirable dust in the mining environment and the development of pneumoconiosis, in order to establish standards of dust control. It has also studied the rate of attack of bronchitis in relation to different dusts.

The Medical Research Council's *Pneumoconiosis Research Unit* has been gaining knowledge of the physiological effects of industrial dusts, coal, hard metal dusts, and of dust analysis.

Our Navy has learnt how submarine crews may now breathe, eat, work and sleep, for weeks on end underwater, and even to go under the ice to the North Pole. The U.S.A. has learnt how to permit their South Pole scientists to live under the ice of Antarctica, and how their moonwalking explorers may breathe in airless space. Meanwhile, all round the globe sub-aqua "frogmen" have learnt to breathe far below the surface of seas, rivers and lakes.

These are all new facts and skills that will help designers, constructors, maintenance men, and users of new long tunnels, who must consider dust, noise, odours, fire and explosion risks, humidity, temperature and many other such things before it is too late to alter plans.

Dust and Fire Risks may come from porous noise absorbing materials used for lining a tunnel. Even if they are not used at least one train a day should include powerful vacuum cleaning equipment to extract dust, debris and litter from track, walls and walkways.

Noise builds up deafeningly in confined spaces by echoing so it must be understood that noise from wheel hammering at rail joints is now inexcusable. In the uniform temperatures of long tunnels, with electric traction, continuous rails, flash-butt welded together are essential. Without them the multiple wheel clattering will make audible warnings impossible and deafen the passengers. Rubber sprung wheel centres should be considered, to minimise railwear and noise, if electrical signalling requirements can be met.

Odours of nitrogen oxides produced by electrical sparking should be considered, and odours from other sources become more noticeable in confined spaces.

Fire Risks from any fixed or mobile sources must be minimised.

Humidity, if excessive, will shorten the useful life of electrical components, signalling, vehicles and track and incommode passengers.

Temperature variations must obviously be avoided as much as possible for the sake of passengers and maintenanc e staff Passengers may not object to a whiff of sea air but the salt will greatly increase corrosion of essential components.

WAC's 21st Birthday

The Womens Advisory Committee of the British Standards Institution celebrated its 21st birthday in March and members of the press were invited to hear the story of WAC's achievements in past years and their plans for the future.

Miss M. George, M.B.E., B.A., Chairman of WAC's Publicity and Conference Sub-committee, and who is also Deputy Chairman of the Executive Council of the Society, gave a short talk on the history of WAC and its future plans. In the field of pollution WAC have attended and participated in conferences and exhibitions in pursuit of bringing pollution to the public's attention and will continue to do so in the future.

Control of Motor Cycle Noise

New motor cycles in the medium size range (125cc-490cc) will have to be quieter from 1973 onwards. This will affect about 20,000 machines a year.

All motor cycles having a cylinder capacity above 125cc but not above 490cc manufactured on or after 1 April 1973 and first used on or after 1 October 1973 will have to be so constructed that they do not exceed a maximum noise level of 84 dBA. The present maximum permissible level for all motor cycles over 125cc is 86 dBA.

The revised limits for motor cycles will therefore be as follows:

50cc or less	77 dBA
Above 50cc but not above 125cc ...	82 dBA
Above 125cc but not above 490cc ...	84 dBA
Above 490cc	86 dBA

POLLUTION FROM ROAD VEHICLES

Conference on Air Pollution Control in Motor Vehicles

This Conference, organised in Solihull by the Automobile Division and Combustion Engines Group of the Institution of Mechanical Engineers on 9th/11th November, discussed the present research results obtained over the last three years relating to Air Pollution from Motor Vehicles.

Many methods of control were reported. These ranged from improvements in carburetters with proposals to get greater accuracy of metering of petrol and air than known before, to modifications to engines to approach complete combustion, and to catalytic and thermal devices placed in the exhaust system to convert noxious gases to harmless emissions. Undesirable pollutants are carbon monoxide, unburnt fuel and nitric oxide. The first two are produced from incomplete combustion, and the latter from the nitrogen and oxygen in the air which is subjected to great heat in the combustion chamber of internal combustion engines.

Although not designed as an international conference, authors came from the United States, Japan, France, Germany, the West Indies and Canada and some 350 delegates from 10 different countries.

The Conference was opened by Mr. G. A. Hunt, Managing Director of Chrysler United Kingdom Limited, and the first lecture was given by Professor F. J. Lawther, Director of the Medical Research Council, Air Pollution Unit. He pointed out that the measured concentrations of pollution in Fleet Street and other areas of London, were very much less than those in cigarette smoke, and that exhaust pollution from motor vehicles was not much of a medical problem in this country. The situation in Los Angeles is very different. Los Angeles is surrounded by Hills, the area retains stagnant atmosphere and a very powerful sun converts unburnt fuel and nitric oxide to a very objectionable smog.

Many of the papers were devoted to meeting the very severe regulations that have been enacted for 1975/76 in the United States to improve these conditions, both in petrol and diesel engines.

It was reported that catalytic devices were available which could reduce pollution to very low levels, but these required extensive endurance testing, and would add to the expense of motoring and could only be justified for the United States or similar conditions as in Tokyo.

Alternative forms of engines were discussed, namely, Wankel rotary engines, steam engines and stratified charge engines. All these, though having certain pollution advantages, also have attendant disadvantages. The Wankel engine was shown to have lower nitric oxide emissions, whilst having higher unburnt fuel emission. Other units, though showing possible long-term pollution advantages, could possibly be twice as expensive to the customer, and would require very large capital investment, and long periods for development.

Finally, in summing up the Conference, it was observed that although many methods were apparently very promising, all would cost money, so that a very balanced outlook was necessary. It was suggested that regulations should be made appropriate to pollution requirements in specific geographical areas, and that these pollutions should be measured before promulgating laws which could be expensive to the customer and would be wasteful of fuel which is a diminishing asset.

The Technical Committee of the Society was represented by Mr. P. Draper, who took an active part in this important conference.

* * *

Road Vehicle Testing

During 1971, the National Society for Clean Air, in its campaign against pollution of the air by road vehicles, carried out a series of tests to measure the carbon monoxide content of vehicle exhausts. By holding these tests the Society hopes to show members of the public not only how their vehicles are polluting the air but also how such pollution can be reduced.

There are, at present, no standards in this country to limit the amount of pollutants emitted from car exhausts, in spite of the ever-increasing numbers of cars on our roads. The legislation in France, Western Germany and Sweden prohibits vehicles from emitting more than 4·5 per cent of carbon monoxide in the exhaust gases whilst the engine is idling, and even stricter limits are imposed in Japan and the U.S.A. British cars exported to these countries are designed and equipped to comply with the limits imposed.

The tests started in July, when the Society, with the co-operation of Brighton Health Department and the Sussex constabulary, organised tests on Brighton seafront, using the Sieger Exhaust Gas Analyser. This instrument employs the electro-catalytic principle and consists of a portable case containing the detection circuitry and controls and a probe unit which is inserted into the vehicle exhaust pipe. The unit indicates on a dial the percentage of carbon monoxide in the exhaust gases.

A random selection of 373 cars were tested. Only 86 of these registered 4·5 per cent or under. 84 registered over 10 per cent. Picking out individual cars tested, one car advertised as a "clean air" car showed a reading of over 10 per cent, while an American car fitted with an anti-pollution device consisting of a recirculating pump showed a reading of 3 per cent. One car was tested twice. The first reading showed 8·5 per cent but after it had been correctly adjusted using a tuning device it registered 1·5 per cent.

The tabulated results seem to indicate that year or type of car do not matter, although it was noted that 85 per cent of the tested cars that were registered in 1971 were over 4·5 per cent. Of the 15 per cent that were within the continental limit, none were British manufactured saloons. Of cars registered in 1961, 75 per cent of those tested were over 4·5 per cent.

In October the Society went to London and, helped by the City of London Police and the City of London Health Department, carried out similar tests in Queen Victoria Street, using the Honeywell Combustion Analyser. This instrument contains two meters; one indicates the percentage of carbon monoxide while the other indicates normal, marginal or poor combustion (hydrocarbon) levels. The instrument was operated by Mr. R. M. Alexander of Honeywell Ltd.

Again, a random selection of cars was tested. Of the 129 cars chosen, only 33 showed a reading of 4·5 per cent or under and 27 cars were emitting more than 10 per cent of carbon monoxide. Cars with low carbon monoxide did not necessarily have a low output of hydrocarbons—59 cars had very high hydrocarbon emission and 50 cars had very low hydrocarbon emissions.

A London taxi was tested which was fitted to use liquid petroleum gas or petrol. The reading for L.P.G. was 0·3 per cent carbon monoxide and extremely low hydrocarbons. When switched to petrol the carbon monoxide was 3 per cent and there was a much higher reading of hydrocarbons.

The most interesting test showed a reading of 0·9 per cent CO and very low hydrocarbons. The driver said the car had been fitted for export with an emission control system, to comply with the very stringent Californian standards—which just proves what can be done. However, proper adjustment of the carburettor, for the 96 cars which were emitting more than 4·5 per cent CO, could have achieved a considerable reduction in carbon monoxide and incidentally, a saving in petrol consumption.

These London tests bore out conclusions drawn in Brighton during July—the fact that only about 20 per cent of cars in this country have a low output of carbon monoxide and year and type of car do not seem to matter.

Drivers were very co-operative and many were anxious for more information on how to reduce exhaust emissions from their cars. Similar tests are being planned this year, the first being in Bristol in March.

ROAD VEHICLE EMISSION TESTING—BRIGHTON, JULY 1971

Year of Car	0.5 under	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Over 10	No. of cars
1932																				1		1
1949						1																1
1955																					1	1
1956					1																	1
1957		1			1	1										1				1		5
1958					2							1				1					1	5
1959			1		1	1		1											1		2	7
1960	1		2											1			1		1	1	3	10
1961		1			2	1									1				1	1	6	13
1962											1	2			3	1	1	1			2	11
1963	1	2		1	1		1	2	1	1		1	1		1						5	18
1964	2	2		1		1		1		1			3	3	2	1			1	1	5	24
1965			2			3	1	1	1	2	1	3	2			3	1	1	3	1	6	31
1966	2		1	1		2			2	1	1	3	2	3	1	2	3	2			9	35
1967		2						3	1	1	1	2		3	1		3	2		1	8	28
1968		2			2	1	1	1	1	1	2		2	2	3	4	1	4	3	3	5	38
1969	2	1	2		1	2	1			3	2	3	2		1	4	3	4	3	3	14	51
1970	2	2	1	1	3		1	1	1	1	4		1	4	1	5	3	3	4	4	8	50
1971	1			1			2	2	1	2	1	2	1	4	2	5	2	2	3	3	9	43
Totals	**11**	**13**	**9**	**5**	**14**	**13**	**7**	**12**	**8**	**13**	**13**	**17**	**14**	**20**	**16**	**27**	**18**	**19**	**20**	**19**	**84**	**373**

373 cars were tested   86 were 4.5% CO or under   84 were over 10% CO

ROAD VEHICLE EMISSION TESTING—LONDON, OCTOBER 1971

Year of Car	0.5 or under	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Over 10	No. of cars
1953																			1			1
1958									1							1						2
1959		1																				1
1960																2				1	1	4
1961																					2	2
1962				1			2							1			1					5
1963						1		1			1								1		1	5
1964																					1	1
1965																	1					1
1966			1					1	1						2		1	1	1		3	11
1967															1						2	3
1968						1	1		1			1		2	1	1		1			2	11
1969	1				1		2						2	2		2		1	1	2	2	16
1970	2	1	1		1		1			1	4		2	1			2	3	2	2	1	24
1971	2				1	1	1	1	1	1	1	1	3		1	2		2			10	28
1972					2				1	2	1		1	1		1	1		1	2	2	15
Totals	**5**	**2**	**2**	**1**	**5**	**3**	**7**	**3**	**5**	**4**	**7**	**2**	**8**	**7**	**5**	**9**	**6**	**8**	**7**	**7**	**27**	**130**

130 cars tested 33 were 4.5% CO or under 27 were over 10% CO 59 cars had high to very high Hydrocarbons emission 50 cars had low Hydrocarbons emission

Taxi fitted with L.P.G. had 0.3% CO and very very low hydrocarbons—when switched to petrol had 3% CO and medium emission of hydrocarbons.

A car fitted with emission control system for export to U.S.A. (to comply with U.S. Standards) had 0.9% CO and very low hydrocarbons.

Smoke Demonstration From Diesel Vehicles

Mr. Eldon Griffiths discusses results.

At the suggestion of Mr. Eldon Griffiths, M.P., Undersecretary for Pollution, Department of the Environment, members of the Clean Air Council were invited to attend the Smoke Demonstration from Diesel Vehicles which was held at M.I.R.A. on the 20 May 1971. The invitation was extended to include representatives from the Society and Messrs. Cayton, Reynolds and Draper were present.

The programme consisted of a smoke demonstration from vehicles on the Proving Ground; talks by Mr A. I. Fosbery, the Assistant director of the Motor Industry Research Association, Mr. Roberts, Chairman of B.S. Committee AU 141 and others. A news conference by Mr. Eldon Griffiths and a general discussion and questions period.

To start the demonstration three diesel vehicles, a Land Rover, a medium lorry and a heavy lorry, were driven past the audience at various smoke intensities controlled by Hartridge Smokemeter readings. Thirty passes in all were made. The audience were issued with log sheets upon which to record acceptable or unacceptable smoke intensities and on which to indicate ' no smoke ', ' light ', ' medium ', or ' dark ', smoke levels. This was the same procedure as that previously carried out at Warren Spring Laboratory when the recorded ' maximum acceptable ' levels were adopted to plot the B.S. A.U. 141 curve to which engine builders could set their test engines. Since the fuel pump ' stops ' were not accessible because they were inside the fuel pumps in accordance with current practice, the smoke levels were adjusted by the introduction of nitrogen or oxygen into the induction manifolds.

The tests in progress.

In none of the 30 runs was a black smoke demonstrated: nor even one that could be rated as dark. Some M.I.R.A. staff were surprised when this comment was made by observers, but what had happened was that the maximum smoke produced on any run was a full scale (100) reading on the Hartridge meter.

During later discussion it was announced that the results reached by the panel of observers, generally agreed with that of the Warren Spring panel but was if anything slightly more tolerant. This was probably due to the very bright sunlight and green or dark background.

Each vehicle was then driven past with the same smoke intensity, as determined by meter, in order to demonstrate that the smaller vehicle gave an apparently lighter visual smoke. Then, each vehicle was driven past with the smoke set to the B.S. A.U. 141 intensity. The observers comments were not recorded but comments ' moderate ' and ' unacceptable ' were heard.

Following this, each vehicle was paraded set to the U.S. maximum acceptable level; these were all medium to dark and quite unacceptable, which was interesting in view of the much stricter controls imposed on petrol vehicles in America. The vehicles were then set to Continental limits and the smoke was even less acceptable.

Finally there was another parade with vehicles set to B.S. A.U. 141, presumably to emphasise that the British limits are better than those of the U.S. or the Continent.

Messrs. Fosbery and Roberts described how they had arrived at the B.S. A.U. 141 maximum smoke curve, which was regarded by them as the "Limiting exhaust gas opacity for engines in new condition". They showed several graphs including one of smokemeter readings from a number of commercial vehicles in use. Rather more than half were producing more smoke than the proposed limits, but quite a number were better than the limits. No reference was made to a margin of safety or allowance for engine deterioration. The impression was given that they were satisfied with the results of their work.

Mr. Eldon Griffiths announced the Department of the Environment's legislation to ensure that all new vehicles should comply with the new B.S. A.U. 141A 1971. He seemed to have accepted that the new Specification would effectively reduce the smoke menace on the road. However he did specifically state that the matter must be treated in a thoroughly practical manner and that the Specification might have to be amended from time to time in the light of experience.

In the discussion which followed Mr. Draper explained that he had been connected with diesel engines since 1926, had worked with four diesel manufacturers and advised major oil companies for over 30 years. It was his impression that although the curve might represent a maximum acceptable smoke level which should not be exceeded by new or old vehicles, he was sure that a margin for deterioration was necessary. He suggested that if all the London buses were set to B.S. A.U. 141 it would not be possible to see the length of Regent Street or Oxford Street.

Undoubtedly a step forward has been made in that legislation has been enacted on smoke from diesel engines and it may well be possible to get B.S. A.U. 141 modified in the future: the present curve might well be accepted as a maximum, with another, lower, curve to be applied to new vehicles.

DESIGNS WITH AIR POLLUTION IN MIND

by

Jeffrey Ollswang, M.Arch.

formerly Assistant Professor of Architecture, Universityof Arizona.
Paper presented to the Scottish Clean Air Conference,1971

During our brief history, mankind has created, and has had to suffer many forms of violence, and has previously, always recovered and survived.

Never before, however, have we been forced to suffer the effects resulting from the massive violence which we are currently perpetrating against our environment; and in turn, ourselves!

It is not a distortion when it is said that air pollution, and its effects upon water, soil, plant and animal life; is a ' domestic ' form of chemical and biological warfare. The tragic irony is that we are waging war against Nature—and never have we fought with more arrogance and success!

Nature is fast losing the battle for survival; and the inevitable results, the pervasive stench of decay is present everywhere. Only the feeble, sometimes evasive symptoms and manifestations of her defeat differ from place to place.

In the hallowed name of ' Progress ', and in our blind, groping rush towards the acquisition of luxuries and comfort, we have thoughtlessly misused and misappropriated our most precious possessions: our natural resources. Perhaps even more frightening is the passive indifference we display while rendering useless—through continued contamination—the, ultimately, limited remaining supplies.

Nowhere is this unforgivable behaviour—and its ominous repercussions, more apparent than in our rapidly vanishing resources of pure water to drink, and fresh air to breathe!

The ' threat ' lies in our complacent refusal to accept the harsh reality that an air pollution crisis does, in fact exist; and in our seeming unwillingness to recognise the tragic consequences which will, most assuredly, occur if we permit further contamination of our atmosphere.

There are those persons who still believe and argue that while ' aesthetically unpleasant ', polluted air is a necessary ' inconvenience ' which can be accepted, especially if we are to realize the full economic benefits generated by ' progress ': industrial-urban growth. One must often wonder, however, whether this growth, if allowed to continue uncontrolled might in the long run, prove to be more malignant than benign.

Past experience should have dramatically emphasised, that the inevitable consequences of air pollution—resulting from uncontrolled industrial urban complexes—are much, much more than simply a ' necessary inconvenience '.

Yet, we continue to accept being exposed to contaminated air—as unsuspecting ' specimens ' in a needless, and grotesque experiment: one which fallaciously supposes that still more scientifically ' conclusive ' evidence is required to prove that breathing polluted air is, in fact, more than simply ' aesthetically unpleasant '.

The positive ' proof ' as it were, already exists in the form of morbidity and mortality statistics—which have painfully been recovered from previous air pollution ' experiments '. These experiments are better known to us as—' acute air pollution episodes '.

Experiment No. 1.
Time and Duration: The first week of December, 1930
Location: Muese River Valley, Belgium
Environmental habitat: Industrial-urban
Positive ' statistics ': Thousands ill—60 dead.

Experiment No. 2.
Time and Duration: Approximately one week, October, 1948
Location: Donora, Pennsylvania, U.S.A.
Environmental habitat: Industrial-urban
Positive ' statistics ': Out of a total population of 14,000; 6,000 are taken seriously ill—and there is a death rate of TEN times the normal.

Experiment No. 3.
Time and Duration: December, 1952, 5 day 'inversion'
Location: London, England
Environmental habitat: Industrial-urban
Positive ' statistics ': 4,000 EXCESS DEATHS.

In the light of these past episodes: It would be dangerous, indeed to assume that similar air pollution disasters could not happen here!

Environmental Planning Objectives: Air Quality Criteria

It is becoming increasingly obvious that it is no longer enough for planners to create economically viable, physically comfortable communities: future industrial habitats will also have to simultaneously afford the inhabitants a clean, pleasant and healthy environment.

If we are going to achieve these environmental standards here, we will necessarily have to carefully examine recent proposals for the industrial-urbanisation of several areas along the Clyde coast. For while these developments, if initiated, may in fact afford some economic relief for the area.

. . . they must also be recognised as posing a severe environmental threat—to the entire Clyde region of western Scotland.

However, the awareness that a threat does exist is, in itself not enough: it is only the first step. In our natural desire to protect and preserve the resources and qualities of the Clyde area—we must not act simply as ' obstructionists '.

The persons and disciplines responsible for the planning and designing of such industrial-urban complexes, as have been proposed should, instead be directing themselves towards the positive task at hand: the establishment of strict environmental guidelines, 'quality' standards and, specifically; ambient air quality criteria.

These standards, guidelines, and criteria must be developed and rigorously enforcd, before we can allow industrial-urbanization of any area: let alone the massive ones proposed for the Clyde coast.

Atmospheric Pollutants: Their Classification and Emissions

We will inadvertently perpetuate the conditions which give rise to air pollution as long as we continue to base air quality criteria, and in turn the implementation of control-abatement programmes, upon dangerously incomplete knowledge.

Even after we have located and designated potential primary sources of atmospheric contaminants—nothing can be accomplished if we do not have at our disposal comprehensive, intimate information concerning the entire scope and range of specific pollutants generated by these sources.

This is especially evident when one considers that the vast majority of our energies have previously been focused solely upon the monitoring and controlling of sulphur dioxide (SO_2) and 'smoke'. That is not to infer that these contaminants are not major, common contributors to the problem of air pollution.

Simply, that sulphur dioxide and 'smoke' do, in fact, represent only part of the total overall problem.

It might facilitate a fuller comprehension as to the scope of the problem, if we were to describe the major classifications of common atmospheric pollutants. It would also enable us to place SO_2 and smoke in their proper frame of reference.

Classification of Common Air Pollutants

Primary Classifications	Individual Classifications	Specific Examples
Organic Gases	Hydrocarbons	Hexane, Benzene, Butane, Methane, Ethylene, Butadiene.
	Aldehydes, Ketones	Formaldehyde, Acetone.
	Other organics	Aromatic and Chlorinated Hydrocarbons, Alcohols.
Inorganic Gases	Oxides of Nitrogen	Nitric oxide (NO) Nitrogen dioxide (NO_2)
	Oxides of Carbon	Carbon monoxide (CO)
	Oxides of Sulphur	Sulphur dioxide (SO_2) Sulphur trioxide (SO_3)
	Halogen compound	Hydrogen fluoride (HF) Chlorine (C1)
	Other Inorganics	Ammonia (NH*t*), Hydrogen-Sulphur (H_2S), mercaptans
Particulates	Solids	Dusts, Fly ash, Smoke, metallic fumes, ammonia, chloride fumes.
	Liquids	Oil mists, acid aerosol mists, entrained liquid droplets.

The importance of acting only upon complete pollution emission data can be readily demonstrated through the case study of a typical primary source of atmospheric pollutants, and, in turn, by describing the full range and extent of the specific pollutants generated from this single source.

To assure reasonable accuracy, and to establish a realistic context in which to carry out this study, let us choose a typical primary source that we have complete emission statistics for—and one, the development of which on the Clyde coast, is currently being investigated: a Petroleum Refinery.

To facilitate this study we will make two assumptions: first that the capacity of the Refinery is approximately 35 million barrels of crude oil per year; and secondly, that abatement procedures have been implemented that would insure the virtual elimination of all 'smoke' and sulphur dioxide!

What type and amounts of specific pollutants would then remain to be indiscriminately dumped into the atmosphere?

*Estimated Annual Emissions from Petroleum Refinery**
(These figures have presumed total control of SO_2 and Smoke)

Process Source *Pollutant: Rate of Emission*	*Amount/year*
a. Boilers and Process Heaters	
Hydrocarbons: 140 lbs/1000 bbls of oil burned	2450 tons/year
Nitrogen Dioxide: 2900 lbs/ bbls of oil burned	50750 ,,
Formaldehyde: 25 lbs bbls of oil burned Methanol, HCHO	437.5 ,,
b. Fluid Catalytic Units	
Hydrocarbons: 220 lbs/1000 bbls of fresh feed	3850 tons/year
Nitrogen Dioxide: 63 lbs/ bbls of fresh feed	1102.5 ,,
Formaldehyde (HCHO): 19 lbs/ bbls of fresh feed	332·5 ,,
Carbon Monoxide: 13,700 lbs/ bbls of fresh feed	239,750 ,,
Anhydrous Ammonia (HH_3); 54 lbs bbls of fresh feed	945 ,,
c. Miscellaneous Process Equipment: Cooling towers, valves, pumps, seals, etc.	
Hydrocarbons: 414 lbs/1000 bbls refinery capacity	7,245 tons/year

Total Emissions Per Year: Specific Pollutants

1. Hydrocarbons	13,545 tons/year
2. Nitrogen Dioxide	51,852·5 ,,
3. Formaldehyde (Methanal HCHO)	770 ,,
4. Carbon Monoxide	239,750 ,,
5. Anhydrous Ammonia (NH_3)	945 ,,

* Calculations based upon statistics appearing in:
"Compilation of Air Pollutant Emission Factors"
U.S. Dept. of Health, Education and Welfare.
Environmental Health Series AP PB 190245—1968.

It follows, then, that the partially controlled Petroleum Refinery in question would propagate and probably emit, unabated, into the atmosphere, something in the range of 307,000 tons of noxious pollutants every year.

There is only one point remaining to be made: an 'epilogue'.

If we continue to respond to air pollution and the ensuing environmental destruction as we have done in the past, and do not in the future implement any and all pollution control and abatement procedures at our disposal, then we will assuredly, and deservedly in our own lifetime live to realise that pollution is a 'dirty' way to die, and an even filthier way to live.

"Lead in the Environment"

A conference organised by the Institute of Petroleum, the Chemical Society and the British Occupational Hygiene Society. 27th January, 1972

by

P. Draper, C. Eng.

The Conference was held at the Lecture Hall of the Zoological Society and was attended by about 250 delegates. It was opened by Sir Eric Ashby FRS who made an extremely useful speech which, as was to be expected, showed a thorough grasp of the subject and of clean air in general. He deplored the " hysterical and mischievous statements which are currently being circulated ".

Six papers were presented during the morning session and the afternoon was devoted to discussion.

The first paper was on sources of Lead in the Environment by Mr R. L. Stubbs, Director-General, Lead and Zinc Development Association. This contained useful factual information about sources and uses of lead, which included the manufacture of batteries, cable sheathing, sheet and pipe, pigments, lead glazes and lead alkyls for motor fuels.

Mr. Stubbs indicated the care that is normally taken at the factories and works using lead and pointed out the danger in some soft (acid) water areas using lead pipes. Lead is being used less and less in paints. About 9,000 tonnes p.a. is being used as anti-knock agent in U.K. petrols. Of this, about one quarter is retained in the engines and exhaust systems and about one half of the remainder falls to ground level rapidly and is washed away. Atmospheric contents of lead from this source are increasing only very slightly.

Professor A. J. Lawther presented a paper on "Airborne Lead and its Uptake by Inhalation ". He gave figures for lead concentrations in the air and showed that this was about five times higher in Fleet Street than on the roof of St. Bartholomew's Hospital. He presented a great many facts and figures, but one could not detect any serious suggestion that lead from petrol could be held responsible for any general medical disorders.

Drs. L. H. A. Jones and C. R. Clement of the Grassland Research Institute, in their paper, " Lead Uptake by Plants and its Significance for Animals ", concluded that there were four barriers restricting the amount of lead passing from the soil to man at the end of the food chain:

A. The soil; only a small amount of lead is available to plant roots.
B. The roots which transfer only a small proportion to the shoots.
C. Only a small portion of that in the animal's alimentary tract is absorbed.
D. Most of that absorbed by the animals accumulates in their bones.

Dr. H. Egan, the Government Chemist, the Department of Trade and Industry, in his paper " Trace Lead in Food " concludes that high lead levels in the blood were largely accounted for by exposure to lead sources other than those in food or water. He stated that the level of lead in food had not changed since 1940.

Dr. R. I. McCallum of the Department of Industrial Health, University of Newcastle, in presenting his paper on " Lead in the Environment: Possible Health Effects on Adults ", claimed that much of the concern about lead from petrol stemmed from non-medical scientists and journalists; he stated that no sound medical evidence had been produced to suggest any significant amount of lead poisoning of the general public.

Dr. D. Barltrop of St. Mary's Hospital, London, talked on " Children and Environmental Lead ". He naturally regarded the care of children of utmost importance; he referred to ingestion of lead by mouth from lead painted articles and said that ingestion from TEL in motor fuels was insignificant compared with it.

During the discussion, several representatives of oil companies pointed to the small amount of evidence that lead from TEL was doing any harm, and explained that a change back to lead-free fuels would be an extremely expensive operation which would not only increase the price of petrol but also reduce the miles per gallon. This would increase the overall consumption of petroleum products. As a result of this, some speakers accused the petroleum industry of trying to balance public health aginst finance, but this attitude of mind was generally dispelled.

One technologist suggested that a switch from the use of TEL to TML would significantly reduce the quantity of lead emitted to the atmosphere, although the latter product is more expensive to produce.

Although it is very difficult to arrive at any definite conclusions because so many aspects were debated, this Conference will have helped to put lead pollution in its proper perspective.

There are hazards from lead sources in some localities, particularly where lead is smelted, recovered and fabricated. There are some individual hazards, particularly to children from lead based paints, and in soft water districts where lead pipes, and even lead-lined tanks, may still be in use. Apart from that, modern techniques of analysis show that lead is very widespread in the soil and air, but since it is very unreactive and relatively insoluble, it does not appear to constitute a menace to health under normal conditions. This also applies to lead from motor fuels. The measured lead content of the air from this source is thought not to have increased for a number of years because the quantity added per gallon has decreased on account of the higher anti-knock value of the base stock.

It must be remembered that modern techniques of analysis can detect and record figures of infinitely minute quantities. This should be borne in mind when using such figures; a few years ago similar levels would have been reported as " trace elements " or even " absent ". Even so, the appreciation of pollution levels is made very confusing to those not using them daily by the multiplicity of units in use. Unfortunately this was painfully evident at this conference.

SOLID SMOKELESS FUELS FEDERATION CONFERENCE AT SUTTON COLDFIELD

In the first of several similar one-day conferences to be held throughout the country, the Solid Smokeless Fuels Federation entertained the representatives of over sixty Local Authorities at the Penns Hall Hotel, Sutton Coldfield, on Tuesday, 7th September, 1971, to introduce Chief Public Health Inspectors, Housing Managers, Architects and the Chairmen of Public Health and Housing Committees to the advantages of solid smokeless fuels, and to two new solid fuel appliances in particular.

In a speech of introduction, Sir Frederick Scopes, the Chairman of the Solid Smokeless Fuels Federation, welcomed the delegates and expressed the confidence of the solid fuel industry and the Federation in the fact that the days of shortage of solid smokeless fuels were gone. He said that solid smokeless fuels had an extremely important part to play in the clean air campaign and in the acceleration in house modernisation programmes now being demanded by the Secretary of State for the Environment and implemented by Local Authorities.

Walter McKinnell, the Chairman of the Solid Smokeless Fuels Federation Local Authority Liaison Committee said that twelve months to two years ago the Federation would not have dared invite Local Authority delegates to a meeting of this type; but early in 1969 the Federation and its individual members had decided that positive action was necessary if the impending shortage of solid smokeless fuels for domestic use was to be a short-term problem and they could look forward to the day when their difficulties had been resolved. The Federation had prophesied that the shortage would be behind them by the Spring of 1971.

Prophesies, said Mr. McKinnell, did not always come true, but thankfully those of the Federation had been more than fulfilled to the extent that during July of this year the Federation was able to inform Local Authorities that the Industry was confident there would be adequate supplies to meet future demands, and they could go ahead with their Smoke Control programmes as quickly as possible.

Mr. McKinnell reinforced his statement by quoting from Circular 53/71 of the Department of the Environment in which the Secretary of State says he "hopes Authorities who during the past two or three years have reduced or discontinued their smoke control programmes will now resume them energetically", and asks "all 'black' area Local Authorities to review their programmes and consider whether more rapid progress can be achieved".

It was because of the Federation's interest in cooperating with Local Authorities in the further development of smoke control areas and housing improvement areas that the Local Authority delegates had been invited to the meeting, and he hoped that what they had to hear during the morning would be of benefit.

In short papers on "Solid Fuel Heating in Small Houses", Mr. C. H. Cutting, Chief Heating Engineer of the Midlothian County Council, and Mr. B. Annable, Deputy Chief Executive of the National Building Agency, Edinburgh, emphasised that in the decade of trips to the moon and the development of nuclear energy, the design of central heating for the average dwelling, which should be a relatively simple subject, was fraught with political and social problems which required Local Authorities to make important decisions.

It was important, said Mr Cutting, to ensure that a Local Authority tenant had a reasonable standard of comfort at lowest cost to himself and to the Local Authority. However, many factors had to be taken into account in assessing "cost", and one must consider, amongst other things, the housewife, (who may go out to work), the ages of the children and whether they used their bedrooms for study. There is no doubt, said Mr. Cutting that the modern housewife generally wants less chores—particularly if she works during the day—and likes to return to a warm house where she can live in controlled heated conditions which are available only with full central heating.

In general, the Local Authority must provide for average heating and comfort requirements of about 50°F-60°F and not for those few tenants who expect 80°F-90°F at all times. Mr. Cutting emphasised that comfort included in addition to correct temperature, adequate standards of ventilation and humidity, with no smoke emission to cause pollution.

Unfortunately, he said, the heating system which required no maintenance had not yet been invented; but low maintenance costs were important. Generally, the more complicated the system, the more costly was the maintenance, and in a competitive market manufacturers are often to blame for producing equipment requiring excessive maintenance. Manufacturers, said Mr. Cutting, should give more serious consideration to the problem of producing control devices to give the technical results required but yet are cheap to manufacture and are both accessible and easy to maintain. This was of particular importance for their Local Authority customers who might enter into contracts for several hundred appliances in any one year.

The Local Authority is generally responsible for the purchase, installation and maintenance of a heating system, whilst the tenant is responsible for its operation and purchase of the fuel. If the fuel costs are too high, the tenant will not use the system fully, will complain of poor performance of the system and—probably—of any condensation which will result from inadequate heating of the building fabric.

A balance must be obtained by the Local Authority between fuel costs and the overall performance, convenience and efficiency of the system. It is important, said Mr. Cutting, that the Local Authority must make the correct decision in the choice of fuel and the Local Authority heating engineer will probably advise the relevant Committee to consider the following points:

a. Is the fuel and the system flexible. Can the tenant control them to his own requirements.

b. Is the system easily understood so that in due course the tenant will not complain of high fuel costs.

c. Is the system adequate for whole house heating so that the tenant will not attempt to overfire a system designed for partial or selective room heating.

d. Is the fuel available at a competitive and stable price.

Additionally, the Local Authority must consider both the capital cost of installation and the cost of maintenance over the full life of the building, in order to compare different types of system.

To summarise, said Mr. Cutting, the Local Authority must consider:

comfort conditions
ease of maintenance of the equipment
reduction of pollution
capital costs
maintenance costs

before deciding what fuel and system they should install in their houses.

Mr. Annable said that the National Building Agency were able to provide Local Authorities with the design of standard heating systems to give Parker Morris heating standards or better. He also emphasised that the running costs of a system were important if the tenant was to make full use of the available heat and thereby avoid condensation and damage to the fabric of the building. Mr. Annable suggested that although some types of solid fuel systems—normally conventional small bore or micro-bore hot water (wet) systems—were more expensive to install, they were cheaper to operate, and were flexible. The National Building Agency were now publishing recommended plans for new housing, including standard heating systems, all based on dimensional co-ordination and "the fitting together of standard parts" in order to reduce building construction costs.

In consultation with the National Building Agency, the National Coal Board have produced packaged designs for fully engineered solid fuel systems for known house types which were composed of standard components to ensure the cheapest purchase price from the manufacturers. The National Coal Board were able to assume where required contractual responsibility for the actual installation work of these systems.

Mr. Annable said that the systems mentioned in the Design Guide were all of the "wet" type and designed so that the appliance was installed in a precast lightweight chamber with a prefabricated flue. Three systems were covered:

i. the open fire giving domestic hot water and ground floor heating to Parker Morris standards;

ii. the coke-fired Roomheater with boiler to provide domestic hot water and either heating to Parker Morris standards or the higher standard of full house heating recommended by the National Coal Board;

iii. the new coal-fired Roomheater to give wherever possible the same heating standards as the systems (ii) above.

At present the new coal-burning appliances are available at only two output levels, but it seemed likely that their popularity would grow and that there would be additional sizes and designs developed.

The Head of Sales Promotion in the National Coal Board, Midlands Region, Mr. C. H. Perry, then gave a quick description of the traditional range of solid fuel burning appliances and spoke at some length on the new CB 34 coal burning room heater produced by Glynwed Foundries and recently made the subject of an Exempted Fireplaces Order by the Department of the Environment so that Local Authorities could install them in Smoke Control Areas and could pay grant for their purchase and installation.

CB 34.

The CB 34, said Mr. Perry, was a further development of the National Coal Board "Housewarmer" which had been designed and tested on a large scale in many parts of the country, but which generally was found to be somewhat undersized for the duty required of it. The National Coal Board had therefore handed the basic principles of the Housewarmer to a small number of manufacturers so that they could develop their own appliances commercially. The CB 34 manufactured by Glynwed Foundries (previously Allied Ironfounders) had an output rating of 34,000 Btu per hour, i.e. 12,000 Btu per hour for direct room heating and 22,000 Btu per hour for radiators and domestic hot water, and was designed to burn selected pre-packed washed bituminous coal singles of low coking quality, specially prepared by the National Coal Board for this family of approved coal burning appliances.

Mr. Perry emphasised the economies available to the housewife by using the CB 34 and said that the average annual heating cost for a three bedroom house was £50.

The second appliance which Mr. Perry described in detail was a development of the Redfyre plus 8, now fitted with a time clock, interval timer, room thermostat, limit thermostat and appliance stat so that the heating system and the room heater were fully automated and capable of full programming similar to more sophisticated and expensive independent boiler systems. This solid smokeless fuel room heater, he said, could be time-programmed to probable heat demand and by means of a kindling mechanism which allowed a small volume of primary air to enter the appliance every 15 minutes, it could slumber for several days without re-fuelling.

Mr. Perry then continued to describe the newly created National Coal Board two-year guarantee, indicating that whereas previously, the customer had a contract between himself and his installers, the National Coal Board had appointed some 300 good class installers in the Midlands as Registered Heating Contractors whose work the Board would guarantee. Each installer registered every installation with the National Coal Board for a small fee and the customer then received a written guarantee from the National Coal Board against appliance defects, defective materials, poor design, workmanship or performance. The guarantee, said Mr. Perry, covered just about everything and was in every way suitable for Local Authority owned properties or private dwellings.

On the question of running costs, Mr. Perry quoted the following figures based on 550 useful therms per year divided into 450 useful therms per year for space heating and 100 useful therms per year for domestic hot water:

a. *Gas* at 5·7p/therm (North Sea gas)
Boiler efficiency 70%

Cost of gas/useful therm	=	8·15p
Standing Charge	=	£15·60
Maintenance	=	£6·00
		£66·60 per year

b. *Oil* at 10p/gallon: 6·2p/therm
Boiler efficiency 70%

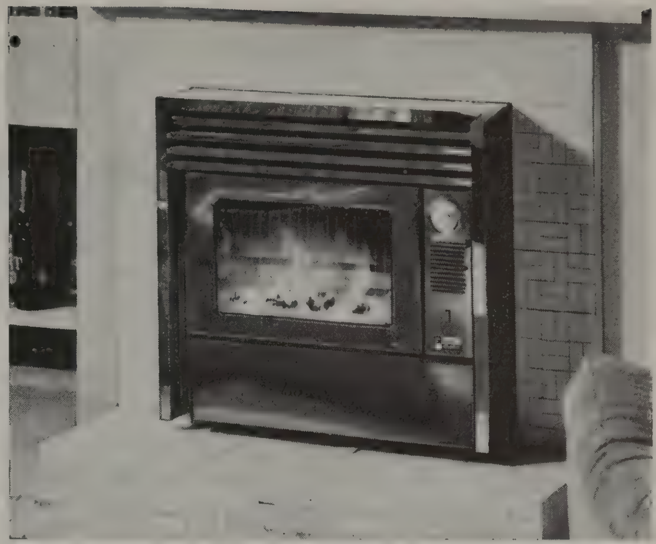
Cost of oil/useful therm	=	8·9p
8·9 × 550	=	£49·00
Maintenance	=	£8·00
		£57·00 per year

c. *Electricity*, said Mr. Perry was similar to gas at approximately **£66·80** per year, provided that all the current was taken at the minimum night rates.

d. *Coal* at £14 per ton (washed pre-packed singles): 5·1p/therm
Boiler efficiency 65%

Cost of coal/useful therm	=	7·8p
7·8 × 550	=	£43·00
Maintenance	=	£2·00
		£45·00 per year

Thus, said Mr. Perry, the low cost of heating by means of the coal-fired room heater "was impressive if not to say staggering".



Coalmaster.

The Women's Advisory Council on Solid Fuel

During the same afternoon, by arrangement with the Solid Smokeless Fuels Federation, the Women's Advisory Council on Solid Fuel entertained 230 members of local Women's Institutes, Townswomen's Guilds and similar organisations to a forum with the theme "Design for Today". The meeting was chaired by Mrs. Joyce Saunders (National Chairman of the Women's Advisory Council on Solid Fuel).

In an illustrated talk "Heating for Today" Mr. Perry of the National Coal Board gave a similar lecture on modern solid fuel heating appliances to the one given to Local Authority delegates earlier in the day. The ladies were then able to fire questions at a panel of solid fuel experts consisting of Mr. D. M. Fletcher, Deputy Regional Marketing Director, National Coal Board, Midlands Region; Mr. C. H. Perry, Head of Sales Promotion, National Coad Board, Midlands Region; Mrs. N. Key, Regional Organiser, W.A.C.S.F.; Mr. R. Pane, Sales Manager, Coalite Ltd; Mr. K. N. P. Arkell, Assistant Sales Manager, Rexco Ltd.; and Mrs. Joyce Saunders.

In addition to hearing the advantages of solid fuel appliances, the delegates to the two meetings were able to see samples of several smokeless fuels, and a range of solid fuel burning appliances, several of which were in actual use burning authorised fuels including, in the case of the CB 34, pre-packed bituminous singles.

Meeting of Fuel Merchants

The concluding function in a very full day's programme was a meeting organised by the S.S.F.F. jointly with the Regional Council of the Coal Merchants' Federation. During the evening fuel merchants from the five Midlands counties gathered together to view the exhibition, to meet the solid smokeless fuel producers and were given the opportunity to ask questions on all aspects of solid smokeless fuels availability and suitability.

National Society for Clean Air

134-137 North Street, Brighton BN1 IRG (Brighton 26313)

The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

National Society For Clean Air

NEWS FROM THE DIVISIONS

EAST MIDLANDS

On the 22nd October 1971, a meeting of the East Midlands Division was held in the Town Hall, Peterborough. Approximately 80 members were present.

In welcoming the members of the Division to Peterborough, the Deputy Mayor, Councillor Mrs. I. D. P. Weaver, said that the reduction of smoke as a result of the Clean Air Acts had resulted in 50 per cent more winter sunshine and there had been no bad fog in London since 1962. She said that it was unfortunate that some authorities had not implemented smoke control procedure and that some had reduced their programmes because of the shortage of solid smokeless fuels. She concluded by saying that the Department of the Environment had expressed the hope that authorities would now resume this work. Peterborough was not in a black area, but it was hoped that by July 1972 almost half of the city would be in smoke control areas.

After the Deputy Mayor's welcome, Alderman A. Lister Robinson, M.B.E., on behalf of the Division, paid tribute to the work which the retiring Honorary Secretary, Mr. G. Drabble, had done for the East Midlands Division and presented Mr. Drabble with an electric shaver as a mark of esteem from the members.

Replying, Mr. Drabble said that he was deeply touched by Alderman Robinson's reference to his work for the East Midlands Division. He had enjoyed the work and did not feel that further recognition was required. Mr. Drabble thanked the members for their generosity and expressed his good wishes for the future.

Next, Councillor C. W. Swift, a member of Peterborough Development Corporation, spoke on the Development Area, which the members were to see in the afternoon.

Cllr. C. E. Holland, Ald. A. Lister Robinson, Cllr. Mrs. Pat Weaver and Mr. E. F. Raven.

He said that the Development Corporation was working to build Greater Peterborough and to increase the population from 66,000 at present to 150,000 at the rate of 5,000 people per year. Peterborough was 76 miles from London and within easy commuter distance. The proposals included 40 new schools and 5 new river and rail bridges. Parts of adjoining authorities would be brought into the City, and 35 miles of new roads and carriageways would be required. The Greater Peterborough would be defined as a Regional Centre into which people would commute from villages within a 20 mile radius and from as far as the town of Wisbech. He said that by 1981 it was anticipated that as many as 16,000 people would be coming in daily.

Only 14 miles east was March, for many years one of the largest Railway Centres, but within the space of a few years all that industry had disappeared. The industrial situation in Peterborough was a fortunate one. There had been little real hardship and unemployment at present was around 4 per cent.

Councillor Swift concluded a most interesting talk by saying that whilst the present generation might not benefit greatly by what was being done, future generations certainly would.

The Honorary Secretary thanked the City Councillors and Deputy Mayor for their kind hospitality.

In the afternoon about 30 members enjoyed bright sunshine whilst they were taken on a conducted tour of the Development Area and given a very comprehensive commentary by Councillor Swift. A stop was made close to what will be one of the biggest stores in Europe with parking for 700 cars. Mr. N. R. Aycliffe, Assistant Chief Engineer (Heating & Structures), Peterborough Development Corporation, gave details of a gas fired District Heating Scheme which will provide heating and hot water for 3,500 houses as well as for the store and neighbouring schools. Mr. Aycliffe later described one of the large new bridges and pointed out that considerable quantities of earth was having to be brought in to landscape this and similar bridges because of the flatness of the surrounding area.

Following the visit tea was served at the Town Hall.

A similar group assembled at the works of the British Sugar Corporation in Oundle Road, Peterborough, by the kind invitation of the General Manager, Mr. E. R. Smith, and they were shown the various steps in processing sugar beet to obtain sugar. The members were also given tea at the kind invitation of the Company.

E. F. Raven
Hon. Secretary

YORKSHIRE DIVISION

On the 7th September 1971, at the kind invitation of Shell-Mex and B.P. Ltd. the Yorkshire Divisional Council visited the Shell Refinery at Teesport.

18 members attended and after a business meeting they were entertained to lunch by the Company. After lunch they were taken to the Refinery. The operation of the Refinery was carefully explained prior to a tour of the site, which occupies some 170 acres on the South bank of the River Tees. Members of the Division were obviously most interested in the types of pollution which might be produced by a refinery and in the ways in which possible pollutants were dealt with. The refinery processes produce large quantities of gas, much at very high pressure, and also quantities of liquid products. Both gases and liquids can have a very offensive smell. It was a surprise therefore to most of the visiting members to note the cleanliness of the site generally and of the plant, and the absence of unpleasant smells in the area. It was explained during the tour that the Company had gained experience in dealing with these problems during the operation of refineries in various parts of the world over a very long period and that all offensive gases are contained within the processes and are then treated or burnt in furnaces. It is only when excessive quantities of gas are produced, as from a process misadventure or an emergency in a unit, that the waste gases are burnt on a 200 ft. high flare stack designed to instantly ignite them as they are vented into the atmosphere. The liquid effluents from the plant are treated by special intercepting tanks, the out-falls from which flow into the Tees and at these points samples are regularly taken to ensure that the water leaving the refinery is clean enough for acceptance by the River Authority.

The Council was much indebted to Shell-Mex and B.P. Ltd. for this opportunity to visit and inspect the workings of a modern treatment plant.

On the 16th November 1971, 25 members of the Divisional Council met at the premises of the Yorkshire Electricity Board with the object of inspecting a new office block constructed to a totally integrated environmental design with no separate heating plant but relying mainly on lighting, human occupation and other incidental heating gains for heating purposes.

Prior to a tour of the office a description of the building was given by Mr. J. W. Watts, C.Eng., M.I.E.E., M.B.I.M., Area Commercial Officer.

Mr. Watts said that to most people the idea of a building which heats itself, has no need of a conventional heating plant and yet costs no more for each employee accommodated would be classed with the idea of perpetual motion—good in principle but impracticable in realisation.

About 3 years ago Y.E.B. were considering centralising all Leeds Area staff at their Gelderd Road site. They were very conscious of the shortcomings of office buildings erected since the war, particularly the wide temperature variations arising from the high area of glazing and the low building mass usually employed. They were also anxious to avoid the inflexibility of layout associated with the conventional use of daylight as the main source of illumination, which restricts the depth of offices to about 20 ft.

The architects were asked to prepare a feasibility study comparing a conventional building with one using windows for contact with the external environment and employing permanent artificial lighting for illumination. The results showed that there could be a sharp reduction in building costs because whereas the conventional building would have had to be six stories high, the proposed building need be of three stories only. The elimination of the core area over three stories and the better use of space possible in the larger office area reduced the overall floor area required from 40,880 sq. ft. to 32,065 sq. ft.

At the same time it became apparent that a smaller building, with a low wall/volume ratio, would have lower heat losses and in the worst weather conditions these would nearly balance heat gains from lighting, human occupation and office machinery. In fact, down to $-1{\cdot}7$°C no additional heating would be necessary and the problem was not one of heating but of redistribution, removing heat from areas such as the core where there was a surplus and redistributing it to the perimeter. This has been accomplished by an air conditioning system which can supply warm or cool air as required to various zones of the building and use the warm air extracted from the office areas as the heat source.

The feasibility study showed that adding the cost of the air conditioning and acoustic control for the large open plan offices (carpets, acoustic panels on walls and acoustic ceiling tiles) to the basic building cost would give a lower total than for a conventional building. Subsequent costing, in the light of the known costs of the new building show that total cost decreased from £286,259 to £228,544, a saving of £9 per employee housed.

The benefits of a temperature controlled environment the year round, and rather more pleasant surroundings than are usually provided are thus bonuses which, in this building cost nothing extra to provide.

Air is extracted from the office areas through the lighting fittings into the ceiling plenum. This air movement cools the fluorescent tubes which then give about 11 per cent extra light output and have a longer life. The warmed air is then ducted to the air conditioning plant on the roof where 10 per cent of it is discarded and an equivalent amount of fresh air added. After filtering, air is returned, warmed or cooled as required according to the setting of thermostats in each zone. Vents for the return air are provided in the ceilings and along the window sills. The specified temperature is 70°F (21°C) and the lighting level is 1,100 lux throughout the building. When surplus heat is not required for heating anywhere in the building, it is discharged to atmosphere via a cooling tower. In the coldest weather and for starting up on very cold mornings, the system can draw heat from a 5,000 gall. hot water storage tank, heated overnight by off peak electricity. In general, the offices are open plan, but private offices are provided for the Manager and three senior staff, and there is a conference room and enclosed areas for office machinery and drawing office printing services. There is complete flexibility for any future rearrangement in the open plan areas. The building therefore provides a pleasant environment for its occupants, who have a good view of the surrounding landscape through windows amounting to 30 per cent of the wall

area. Temperatures are constant, winter and summer and there is the additional benefit of clean air from the air conditioning system which reduces cleaning costs. From the point of view of environmental control there are no fumes or smoke and by re-using for heating purposes the total energy input to the building there is a conservation of national fuel resources.

Again the Yorkshire Division were very appreciative of the opportunity of observing the very successful design of this particular building.

J. H. Wyatt
Hon. Secretary

NORTHERN IRELAND

The Annual General Meeting of the Northern Ireland Division was held in B.M.A. House, 609 Ormeau Road, Belfast, on Wednesday, 26th January 1972, at 2.30 p.m. The Chairman, Mr. R. Campbell Brown, Director of Research and Education, Davidson and Company Ltd., presided over a large attendance of members.

Before presenting his review for the year 1971, the Chairman referred to the sudden and untimely death of Mr. Alan Cusdin, who had been a loyal and active member of the Divisional Council and whose wise counsel had been of great benefit to his colleagues. As a tribute to his memory members stood observing a minute's silence.

The Chairman stated in his review that the availability of smokeless fuel in Northern Ireland continued to be satisfactory and the Province's smoke control programme continued to make headway during the year. Some redirection of effort had had to be made in those Local Authorities directly affected by civil disturbances but this, he stated, had had no overall effect on the progress of smoke control. At the end of the year 36 smoke control orders were in operation— an increase of five on the previous year's figures. Other smoke control orders were in the pipeline and the Chairman paid tribute to Local Authorities in Northern Ireland for maintaining progress during a most difficult year. The Chairman then referred to the solid smokeless fuel plant operated by Cawoods Patent Fuels Ltd., Belfast, which, he hoped, would shortly be in a position to make a commercial contribution to Northern Ireland's smokeless fuel supply position. He informed members that tests were still being carried out by the company regarding the production of a smokeless ovoid having the characteristic of anthracite and which would be marketed under the name 'Maxiglow'. The Division had, during the year, encouraged and assisted many interested individuals, schools, organizations etc. who wanted information and advice regarding air pollution. The Chairman stated that one of the Society's principal aims must be to promote the growth of an informed body of public opinion and where better to start but at school level. The Chairman thanked all members of the Divisional Council for their help and support throughout the year and also those Local Authorities, public bodies and their officers, and industrial and commercial concerns who had shown a continued interest in the work of the Society. Finally the Chairman paid a sincere personal tribute to the former Honorary Secretary of the Division, Mr. Bill O'Brien, whose hard work and enthusiasm had done much to further the cause of clean air.

Following the presentation of the Chairman's review the election of officers took place and the following members were elected to serve for the year 1972:

Chairman:
R. Campbell Brown, Davidson & Co. Ltd., Belfast.

Deputy Chairman:
W. Jenkins, Belfast County Borough.

Hon. Secretary/Treasurer:
B. P. Hanna, Belfast County Borough.

Divisional Council:
The Chairman, Deputy Chairman, Honorary Secretary/Treasurer, Councillor Walter Shannon, J.P., W. J. Davison, J. Stanley Gardiner, Col. H. J. Porter, A. Reynolds, Dr. J. McA. Taggart, W. E. C. O'Brien, K. Lynas and A. O'Neill.

Before concluding the business of the meeting the Chairman drew the attention of members to the Division's next one-day meeting which would be held in the Slieve Donard Hotel, Newcastle, Co. Down, on Tuesday, 16th May 1972.

On conclusion of the business the Chairman introduced Mr. D. Hinchliff, Alkali and Radiochemical Inspector for Northern Ireland, who had come along to give a short illustrated talk on the 'Maxiglow' smokeless fuel plant operated by Cawoods Patent Fuels Ltd., Belfast. Mr. Hinchliff informed members that a process had been in operation for many years at this site manufacturing dimpled ovoids from anthracite screenings containing 6 per cent pitch. The new process was, he continued, an addition to this, taking the ovoids through a further operation to drive off the volatiles. In the new plant the 'green' ovoids fall on to a moving grate forming a bed of fuel 18 in. deep and are heated by very coarse sand ($\frac{1}{8}$ in. to 1/16 in. mesh). The temperature of the sand is 650°C and the sand is raised by elevator bins from a sand heating furnace fired by a pressure jet burner using 35 second oil. Hot gases from the fuel bed are recirculated to this sand heating furnace and sand falling through the grate, along with sand separated from carbonised ovoids, is returned for re-heating and recirculation. Exhaust gases are passed through electrostatic precipitators which, Mr. Hinchliff stated, have ensured satisfactory emission levels of grit and dust. Mr. Hinchliff told members that certain operational difficulties had been experienced—e.g. damage to extractor fans, early combustion of gases above fuel bed—but these were gradually being overcome. It was hoped that the commercial production of 'Maxiglow' would soon be a reality. A lively discussion followed Mr. Hinchliff's talk and members were interested to learn from Mr. D. G. Barrett, Coal Advisory Service, that it was hoped to produce about one-eighth of Northern Ireland's solid smokeless fuel at this plant taking present day consumption levels as a guide.

The Chairman thanked Mr. Hinchliff most sincerely for his informative talk and brought the meeting to a close by inviting members to take afternoon tea before departing home.

B. P. Hanna
Hon. Secretary

NORTH WEST

On Friday, 14th January 1972, members of the North West Division visited the premises of Robinson Willey at Old Swan, Liverpool.

Members assembled at Allerton Hall, Allerton, Liverpool, for morning coffee and a very interesting description of the aims of the Company and their various heating appliances was given.

In opening the meeting Mr. R. W. Hollingdale, Chairman of the North West Divisional Council of the National Society for Clean Air, welcomed Rear Admiral P. G. Sharp, C.B., D.S.C., Director of the National Society. The Chairman said he hoped the Director and the members would enjoy the meeting and obtain a great deal of information.

Rear Admiral Sharp addressing the meeting, said he always enjoyed visiting the North West and on this occasion he had the pleasure of sleeping in the Captain's cabin aboard his old ship.

He continued that clean air was a matter for everybody—manufacturers, fuel industrialists and the general public. This meeting made it possible for Industry to show the efforts they were making by producing new smokeless burning appliances. There was still a great need for more knowledge of the atmosphere and pollution; in this connection the National Society for Clean Air were to hold a Spring Seminar at the Grand Hotel, Manchester. This suggested that we had started our spring cleaning and it was fitting that it should start in the North West which he felt had improved tremendously over the past few years. The Director thanked Robinson Willey for the opportunity to visit their factory and for providing the members with so much information concerning their appliances.

Mr. Ward, General Sales Manager of Robinson Willey Limited, welcomed the members of the Division to Allerton Hall, he said he was aware of the work of the Society and was delighted to have the opportunity to entertain the members of the North West Division.

Mr. Ward introduced to the meeting a group of technical members of his firm so that after the meeting members would be able to have their questions answered.

Mr. Robertson of Robinson Willey spoke on the firm's entry into the gas fire market. The firm first came into the heating appliance market in 1887 and he read a letter received by the Company from a customer of that time. The letter congratulated the firm on the cleanliness and efficiency of their appliance. Mr. Robertson then demonstrated the Esse 40BBU gas fired boiler which it was hoped would make an impact in the field of clean air. This appliance was constructed to provide easy fitting and maintenance.

Mr. Barber, Technical Director, gave a demonstration of a balanced flue and showed how this principle was used in the construction of the heating appliances produced by Robinson Willey.

Mr. Kirkup, North West Area Manager, spoke on the various types of appliances available; he demonstrated the new push button control on their newest appliance, the Fire Crown.

Mr. Ward in summarizing what had been said by his colleagues felt that the members would appreciate fully what had been said when the visit was made to the factory.

Members of the Division were welcomed and then entertained to lunch by Mr. R. H. Bennett, Marketing Director of Robinson Willey.

Mr. Hollingdale, on behalf of all members of the Division, thanked Mr. Bennett and his colleagues for a very interesting visit. He was sure that all members of the Division present would have benefited from the information which they had received.

W. E. Pollitt
Hon. Secretary

SOUTH EAST

A New Look at the Clean Air Act—Its Relation to the Weather

An address to the Division by Professor R. S. Scorer

In thinking about pollution we ought, at this stage in evolution, to think of man's industrial effluents as an extension of the biological mechanisms which have been going on for the last hundred million years or so. They are unlikely to have effects in the least comparable with those of previous geological eras, and it is simply the rapidity with which we are making changes that matters.

We have to think of the whole atmosphere as being composed of somebody's pollution. The nitrogen, oxygen, carbon dioxide and water vapour are all cycled biologically continuously through the atmosphere, even though they are regarded as the major components of it. But sulphur dioxide is also important to life, and it is only regarded as pollution because it is so readily removed from the atmosphere that it is impossible to say what the average concentration is. Only because we have created local high concentrations of it has it become a problem.

Dust and other particulate material in the atmosphere due to natural mechanisms are much greater in total quantity than what man has put in. One of the main reasons for this is that industry is located mostly in latitudes of moderate or high rainfall so that what man puts in is much more quickly washed out than desert dust and smoke and ash from fires in semi-arid regions.

There are four layers in the earth's atmosphere from the point of view of pollution—(1) the ground layer, up to two building heights or so, from which pollution is removed directly on to the ground, trees, etc.; (2) the layer up to cloud base, which is usually well mixed, in which pollution is carried upwards to dilute it to tolerable concentrations; (3) the cloud layer, which pollution can only enter most of the time inside ascending clouds, and it is in this layer that rain is formed which has the effect of washing the pollution down to the ground and; (4) the stratosphere, where there are very slow motions for getting rid of pollution, and the higher we go the longer pollution will remain, up to ten years at a height of 25-30 k.m. for example.

Pollution problems mainly occur where the bottom layers of the atmosphere become temporarily stagnant. One of the main effects of the Clean Air Act was to get rid of urban smoke, and this has had an enormously beneficial effect in letting through sunshine which warms the ground and creates convection currents up to cloud base level, thereby diluting the pollution to acceptable concentrations. The importance of this cannot be overstressed because it is one of the things we can really do something about. If we examine all the things we might have done in 1952, getting rid of visible particulate material from the air was the most practicable; obviously we could not put 300 foot chimneys on houses, so what better than to facilitate to the maximum the natural dilution processes.

The result is that car exhaust has now become the major air pollution problem in cities where the Act has been applied. It is emitted at a low level and is fairly easy to make clean, though it still remains objectionable in areas of dense traffic. What can we learn from the Clean Air Act? We did a very sensible thing in that act by equipping everyone in selected areas, which were gradually expanded, with the means to avoid making smoke. The need to threaten prosecutions was avoided and this must be regarded as a very important element in legislation—to avoid the likelihood of or intention to have many prosecutions. We also produced clean areas effectively. The lesson is that it might be best to think in terms of clean exhaust areas (like parking meter zones) in which only vehicles with exhausts certified as coming up to the best standards would be allowed.

The effect of doing this would be to create clean air areas of definite value without wasting resources on cleaning up the exhaust of vehicles which only operate in areas where there is no pollution problem.

The effect of the Clean Air Act would have been much less if the same effort had been distributed in a random way over the households of the country. There is the obvious difficulty that cars move about, but the community would soon get used to keeping uncertified exhausts out of the clean areas.

The value of the Society in the operation of the Clean Air Act was enormous. It acted as a means of education of Local Authorities in what was needed and of the legislators in what was possible. It did the homework that was necessary so that the Act was almost ready for Parliament when Parliament asked for it through a private members bill.

Looking to the future, there is much more need for political parties to think out their policies. We are moving into a situation where kinds of legislation needed for pollution control will produce important side effects which have nothing to do with pollution. For example, if we proposed to shift the tax burden from income to fuel, the creator of wealth, on the grounds that it is also the creator of pollution, we might improve fuel efficiency and reduce wastage, avoid accidents like the Torrey Canyon disaster, and stop people putting sump oil down the drain by making it valuable. If we put a 900 per cent tax on oil and other fuels this might happen, but there would be other consequences such as a great increase in the relative price of transport. This would raise many political issues because it would alter the magnitudes of many constraints and incentives in the economy. We must certainly be prepared for a revolution of this kind, but it will not come unless the political parties do their homework. The Society can be an important source of information and experience to the policy makers in the future.

Professor Scorer's address was followed by a discussion in which several members took part This discussion was opened by Mr. J. R. Scott of Oxford.

R. F. Shapter
Hon. Secretary

Liaison Between Industry and Local Authority

The inaugural meeting of the Pollution Prevention Panel took place at the Council House, Coventry, in the early part of 1971, when approximately fifty representatives of local industry and local authority officers were received by His Worship the Lord Mayor, Alderman T. Meffen.

The aims and objects of the then proposed Liaison Panel were outlined by Councillor Harvey Williams, Chairman of the Public Protection Committee, and Mr. A. D. Allen, Chief Public Health Inspector, City of Coventry. These objects were that a local environmental control panel should be formed from industry's works and plant engineers and technical staffs and the local authority's technical officers, to pool information and " Know-how " to solve and prevent industrial pollution of air, land and water in the City.

The Steering Committee of the Panel has met on three occasions since the first meeting in order to plan measures to improve and maintain Coventry's environment, and periodical newsletters giving information of legal and technical requirements applicable to all factories is produced at regular intervals. The first two newsletters may be obtained on loan from the Society.

Reader Enquiry Service No. **7228**

Reader Enquiry Service No. **722**

"Air Knows No Frontiers"

INTERNATIONAL NEWS

SWITZERLAND

Survey of the organization and functioning of the Air Hygiene Laboratory of the City of Zürich
by W. Hess
Health Inspector, City of Zürich

Background

When, just under 10 years ago, the Zürich City Council gave its consent to the expansion of the Health Inspectorate, the Department of Air Hygiene was one of the first of the new service branches to be established. On 1 January 1961, the supervisor of this group, a chemist, was engaged. At first the laboratory was located at the City Swimming Pool; later it moved to rented space. A series of systematic investigations in the area of air hygiene were undertaken very soon afterwards. Successive expansion of the apparatus available, and increases in staff, went hand in hand with the solving of new tasks which kept arising.

A sort of "premiere" was celebrated with the completion of the oil burner test. Indeed, as the first city in the world, Zürich's Health Inspectorate carried out checks, in the form of a test, of more than 700 oil burners in regard to pollution of urban air. The results, which showed some 40 per cent of the oil burners to be deficient from the standpoint of air hygiene, was quite surprising and registered with astonishment and deep concern amongst the experts.

Since the creation of the Air Hygiene Laboratory of the City of Zürich, more than 100 investigation reports have been written and no less than 19 publications have appeared to date. These works are of an informative, technical nature, but can also be classified as scientific.

Furthermore, the conducting of the most diverse kinds of tasks dictated that a large number of measuring and investigative instruments be developed by the group itself. It can also be said, without boasting, that a series of pioneer tasks were accomplished. The greater part of these pieces of equipment is still in operation and has not only proved itself, but has also been adopted by other laboratories for carrying out their work. A short technical description is included in the technical section of this report. Finally, it can be pointed out at this point, that the staff of the current Department of Air Hygiene consists of eight people. Apart from the graduate chemist already mentioned, there is a further chemist, three laboratory assistants, a technician, a clerk and an inspector.

Legislation

Despite the fact community, canton and even federal officials often complain that there are far too few legal regulations in the area of air hygiene, it must be stated clearly that the "law collection" which can be drawn upon for enforcing air-hygienic requirements is quite voluminous. However, the work is made rather difficult by the fact that the individual legal regulations are heavily fragmented and extend into all sectors of public law. It is therefore in this regard useful for providing a survey of the entire legal picture which exists today. The following picture results:

Federal, cantonal and community laws for combatting emissions

Status as of November 1970

A. Federal laws and regulations

Art. 31 bis and 37 bis of the Federal Constitution empower the Federal Government to promulgate regulations against emissions from commercial and industrial operations and from motor vehicle traffic.

Swiss Civil Law Book of 10 December 1907

Art. 679: Responsibility of the property owner.

"If anyone is damaged or threatened with damages through a property owner overstepping his property right, he is entitled to sue for relief of the damage or for protection against the threatened damages."

Art. 684: Right of a neighbour.

"Every person is obligated, in the use of his property, particularly in the conduct of a trade on his property, to refrain from any excessive influence on the property of the neighbours. Prohibited are, in particular, all harmful and (depending on locations and nature of the pieces of property or depending on local customs) unjustified influences through smoke or soot, annoying fumes, noise or vibrations."

Federal law concerning work in industry, trade and commerce (work law) of 13 March 1964

Art. 6: Obligations of the employer (cipher 1).

"The employer is obligated to protect the life and health of the employees and to protect the operation's surroundings from harmful and annoying influences, to take steps which experience teaches to be necessary, which are applicable according to the status of technology and which are suitable to the conditions of the operation."

Federal law concerning street traffic (19.12.58)

Art. 42: Avoidance of nuisances.

"The vehicle operator must avoid every avoidable nuisance with respect to the users of the streets and those living along them, namely through the avoidance of noise, dust, smoke and odours, and wherever possible by not frightening animals."

Regulation concerning street traffic rules (VRV) (13 November 1962)

Art. 34: Avoidance of other nuisances.

"[1]Motor vehicles are to be maintained and used in such a way that they do not develop any smoke which can be avoided.

[2]The engine shall be turned off even during brief halts, if this does not delay restarting.
[3]The vehicle operator shall drive on dusty, dirty or wet streets, particularly in the case of melting snow, in such a way that people using the streets and those living along them are not subjected to annoyance."

Regulation concerning construction and equipping of street vehicles (27 August 1969)
Art. 21: Exhaust, exhaust gases, silencing.
"[3]Vehicle and working engines and their exhaust equipment must be constructed and maintained in such a way that no more harmful substances are emitted than can be avoided according to the status of technology. (For smoke measurement and exhaust detoxication see Annex.) In the case of four-stroke engines with applied ignition, vapours and gases from the crankcase shall be returned for recombustion."

B. Cantonal laws and regulations

Law concerning health authorities (4 November 1962)
§ 74: Supplementary protective measures:
"The public health authorities of the communities are generally responsible for the prevention of damages to health and the elimination of dangers to public health. They are empowered to intervene against nuisances through smoke, soot, fumes, noise, vibrations as well as against water pollution and the like. They are obligated to do so when health hazards exist."
§ 75: Enforcement regulations:
"The communities may promulgate regulations for this. If a common regulation proves necessary to combat certain health hazards, the cantonal government may promulgate it."

Building law for localities with urban conditions (23 April 1893)
§ 96: "If the nature of a business or special equipment in a building lead to phenomena which, while they are not directly hazardous to the health of humans or animals, are a nuisance to neighbours in excessive measure, such as foul odours, heavy smoke or dust development, loud noise or heavy ground vibrations, the owner is obligated to take those precautions which, according to the status of technology at the time, will reduce the nuisance to the lowest level.
Over and above this, the respective rooms are to be closed off against the surroundings as well as possible. In the case of industrial burners, the community council is empowered to prescribe the height of the chimney and the installation of suitable equipment for reducing the development of smoke."

Regulation concerning general and residential hygiene (20 March 1967)
Measures against emissions.
§ 2: "Dangerous or annoying emissions of all kinds, namely pollution of the air, noise and vibrations, are to be combatted.
If the cases involved are trival or exclusively concern the avoidance of property damage, the injured party can be advised to pursue the matter under civil law Civil Law Book, Art. 679 and 684)."
§ 3: "Heating installations are to be adjusted and operated in such a way that the discharge of smoke, soot and undesired exhaust gases is held to a minimum. The cantonal government is empowered to promulgate binding guidelines with regard to checking and the cost of it."
§ 4: "Industrial and commercial operations are to be set up and operated in such a way that the surrounding area is protected from dangerous or annoying effects."
§ 8: "The communities promulgate the necessary regulations to combat emissions. They are so empowered to order the checking of measurements.
The communities may prohibit the operations of industrial and commercial businesses or other disturbing plants and installations in their entirety or partially, if the nuisances cannot be eliminated sufficiently or if measures are not carried out despite orders by the authorities. Under the same assumptions, the keeping of animals can be limited or prohibited."

C. Regulations of the City of Zürich

Building regulations of the City of Zürich (12 June 1963, modified on 16 April 1969)
Art. 26: Industrial and commercial businesses.
"When existing industrial and commercial businesses are expanded, the neighbourhood in zones D and E may not be subjected to annoyance, and the neighbourhood in zones A, B and C may not be subjected to serious annoyance."

General police regulation (14 October 1959)
Art. 13[1]: Excessive nuisances through vibrations, noise, dust, smoke, soot or odours, and health-damaging exhaust gases, are prohibited."
Art. 14: "The proprietor of a business shall take all steps, consonant with the status of technology at the time, to prevent excessive nuisances. Should he fail to do this, or should a satisfactory protection of the surrounding area prove impossible, the government is empowered to take steps within the framework of the legal regulations and if necessary, to order the disturbing business to be closed."

Regulation concerning garbage removal (17 November 1965)
Art. 24: "Excess garbage removal includes all quantities of garbage from households, business, commercial or industrial operations, when it exceeds eight litres per room per week over extended periods, also bulky refuse from business, commercial and fabrication operations, gardening sheds, slags and ashes from central heating plant and commercial operations, building rubble, pit rubbish, carbide residues, cleaning rags and residues from oil separators and similar installations, but not the removal of animal refuse."
Art. 25: "The use of the excess garbage removal is obligatory. Exceptions can be approved by the Head of the Health and Economic Department, if there is assurance that the refuse will be disposed of in another way which is hygienically flawless. The Health Inspectorate is responsible for checking private despositions of refuse."
Art. 28: "The operation of private equipment for incinerating garbage or for disposing of it in other ways is only permitted under sanction of the City Council."

General

Apart from the regulations listed, it is also necessary to observe the regulations of the fire police, the building police, the public-order police and insurance bodies (SUVA), etc. In the case of legal orders, violation of the prohibition expressed therein results in the application of Art. 292 of the Swiss Punishment Code—disobeying of official decrees:

"Whoever fails to obey a decree issued to him by a responsible public authority with reference made to the punishment threatened in this Article, shall be punished by confinement or by fine."

Survey of the apparatus available

Today, the city's laboratories for air hygiene are located at Beckenhofstrasse 59. Seven rooms are available to the Department, plus two further rooms for storage. In the following summary, each instrument is listed with a short description. It is worthy of note that a large number of instruments were procured and lent to the City of Zürich for use, by the Federal Commission for Air Hygiene (EKL). At the same time, we carried out certain investigations for the Federal Commission for Air Hygiene and gave them the results. In the following, we shall attempt to give summary references on the equipment required, in order to be of some help to authorities or other persons interested in setting up air hygiene laboratories.

Carbon monoxide measuring installation for six sampling locations

This instrument is used to determine the carbon monoxide concentration caused by auto traffic at six different locations within a radius of about 50 m. To do this, air is continually drawn in at each sampling location and fed from each location in turn to the CO measuring device "URAS". The momentary value of CO concentration is read off every six minutes for each sampling location, and from this a half-hour average is calculated.

The measuring effect of the "URAS" is based on the infra-red absorption of the carbon monoxide. The attenuation of the infra-red radiation by the gas being measured is determined and the value amplified electronically. The results are recorded with a continuous-line recording instrument and also with a data logger. Measurement range: 0-100 ppm of CO (1 ppm of CO = 1 cm^3 of CO per m^3 of air).

The equipment is made by Hartmann & Braun Ltd., Frankfurt-Main.

Fig. 1 shows the equipment, which can be built into the measuring van as shown.

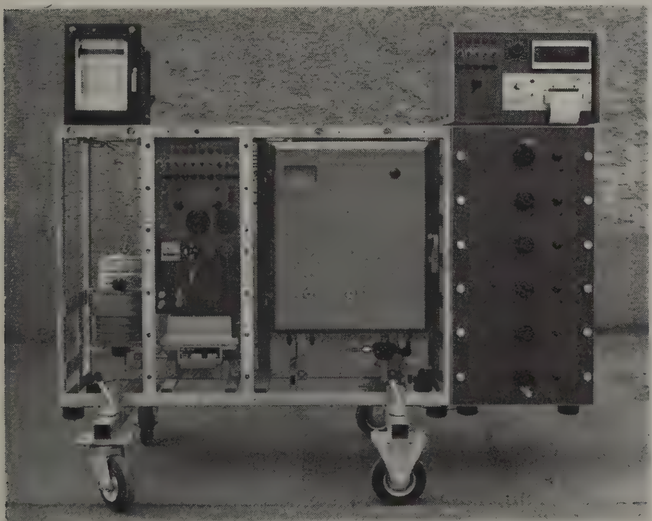


Fig. 1.

Carbon monoxide measuring instrument UNOR for adjusting carburettors

According to the federal regulation on the construction and equipment of motor vehicles dated 27 August 1969, the CO discharge from petrol engines must be limited. It may be at the most 4·5 per cent of CO, measured during idling, with the engine at operating temperature. This measuring device, with a range up to 10 per cent of CO, is employed for these investigations.

Measuring principle:

The non-dispersive infra-red gas analyzer UNOR works continuously, in that the absorption of the infra-red radiation by the CO is converted into an electrical signal with the help of a membrane condenser. This is amplified electronically and the carbon monoxide concentration can be read off continuously.

This instrument is shown in Fig. 2, and is manufactured by H. Maihak AG, Hamburg.

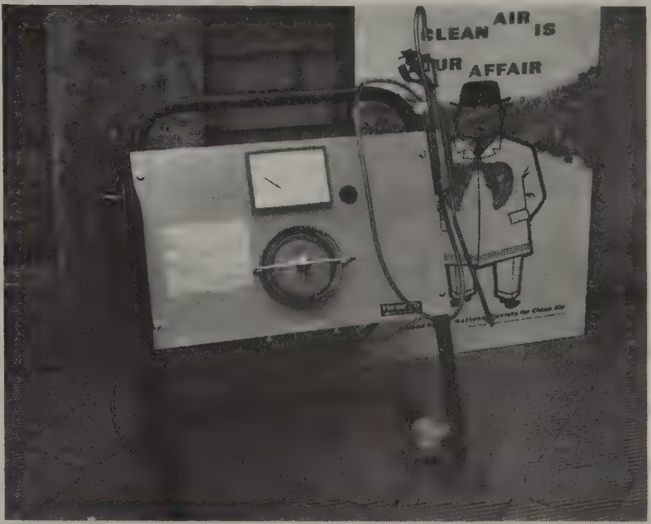


Fig. 2.

*Total hydrocarbon analyzer "Beckman"**

With the total hydyrocarbon analyzer, the amount of all unburned petrol constituents is determined. The measurement runs continually and is capable of picking up petrol concentrations of less than one ppm (cm^3/m^3 of air).

The air to be measured is blown into a hydrogen flame. This causes the petrol constituents to combust, and it ionizes the flame. With the aid of electrodes, this ionization is determined and the signals are amplified electronically. The concentration is recorded with a continuous-line recording instrument.

The equipment is shown in Fig. 3, without flasks, and is manufactured by Beckman Instruments International SA, Geneva.

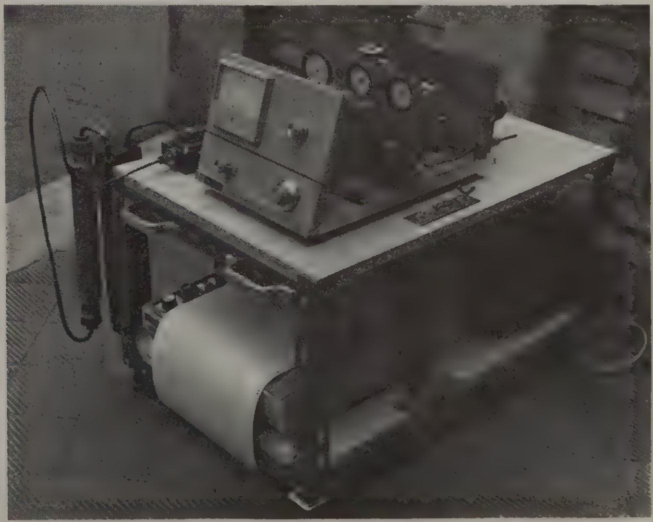


Fig. 3.

Sulphur dioxide measuring instrument "Beckmen"

This continuous measuring instrument is used only in special cases for the determination of sulphur dioxide, since its sensitivity is relatively low.

The sulphur dioxide (SO_2) is absorbed in a reaction interval in a solution containing hydrogen peroxide and converted to sulphuric acid. From the difference in conductivity of the pure solution and that containing sulphuric acid, an electric current is created. This is amplified and recorded with a continuous-line recording instrument.

It is proportional to the sulphur dioxide concentration in the air, so that this may be calculated.

The equipment is manufactured by Beckman Instruments, Fullerton, California/USA.

Dust-monitoring instrument "SIGRIST"

The SIGRIST dust monitoring instrument is used for the most varied dust measurements, for instance, on the street, in road tunnels, for the measurement of dust emissions from industrial installations, etc. Changes in dust content are picked up rapidly, so that short-term dust development may be recorded as well.

The scattered light caused by the dust particles is measured by a photocell and the light intensity converted into photocurrent. This is amplified and recorded. With this method, very low quantities of dust may be picked up.

This equipment is manufactured by Sigrist-Photometer AG, Zürich.

*AISI dust measuring instrument**

The AISI dust measuring instrument is used for the determination of dust suspended in the air. We have used it for continuous monitoring of the dust content of the city air.

The air to be analyzed is drawn through a cellulose filter paper, on which the dust is deposited. At periodic intervals the paper strip is moved farther along, and a new patch of dust forms. The density of the dust patch is determined photoelectrically, and from this the average dust content of the air being analyzed can be calculated.

The equipment is manufactured by Research Appliance Co., Allison Park, Pennsylvania/USA.

Sample collector for graphimetric dust determinations

The sample collector is used to gather large quantities of dust, which are then used for determining the content of lead and 3·4-benzpyrene.

A measured amount of street air is filtered through a filter of cellulose-fibre paper and the separated dust is weighed.

The manufacturer of this equipment is Federal Material Testing Facility (EMPA), Dübendorf.

Automatic sample collector

Using the automatic sample collector, ten air samples can be drawn within a definite period. The air to be investigated is drawn through a wash bottle for a certain set time, the bottle containing a washing solution suitable for the desired determination. After a set delay period, the next wash bottle is flushed through. This procedure is repeated until all ten samples have been collected. These are then subsequently investigated in the laboratory for their content of the substances sought. Thanks to the automatic control, samples can be drawn at any time of the day or night without operating personnel.

This equipment is manufactured by Health Inspectorate of the City of Zürich.

The controls, as well as the 10 sample bottles with their associated selenoid valves, is shown in Fig. 4.

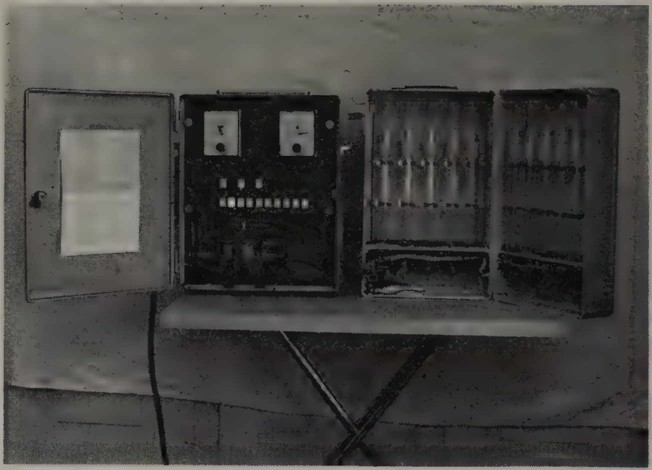


Fig. 4.

DRAEGER continuous measuring pump

The determination of gases in the air can be carried out simply and rapidly using DRAEGER tubes. The air to be measured is drawn intermittently through a small tube, the contents of which react specifically with the substance sought. If the suspected constituent is present, the contents of the tube discolours along part of its length. The length of the discoloured zone on the printed scale allows the concentration of the gas to be read off directly.

Depending on the concentration of the substance sought, up to one hundred suction strokes are required with this measuring method.

With the aid of the continuous measuring pump, these can follow automatically, so that even small concentrations of a desired substance may be picked up. Since test tubes for more than a 100 gases are available, this method can be used universally. For measurements with a low number of strokes, a manual measuring pump can be used as well.

This equipment is manufactured by Draegerwerk Luebeck.

BOSCH diesel-smoke tester

The emission of soot from vehicles with diesel engines is a source of repeated nuisances. Therefore, the federal regulation concerning construction and equipment of motor vehicles stipulates the permissible smoke discharge from diesel engines. According to this regulation, a BOSCH diesel tester must be used for checking the engines according to the acceleration method.

The BOSCH diesel smoke tester works according to the filter paper method. It is one of the indirectly-indicating measuring instruments for exhaust gases. Using a dosing pump, one removes a certain amount of exhaust gas from the exhaust pipe of the engine in question and allows it to be drawn through a filter paper of known area. The blackening resulting on the filter paper is a measurement of the soot content of the exhaust gases. The evaluation of the blackened filter paper is accomplished using an evaluation scale (grey-tone scale).

The equipment is manufactured by Robert Bosch AG, Zürich.

Oil-burner tester

To check oil burners for emission of soot and unburned oil constituents, the oil-burner tester is used. If the check of the installation shows that the content of undesired substances in the flue gases is excessive, the owner must have the burner readjusted.

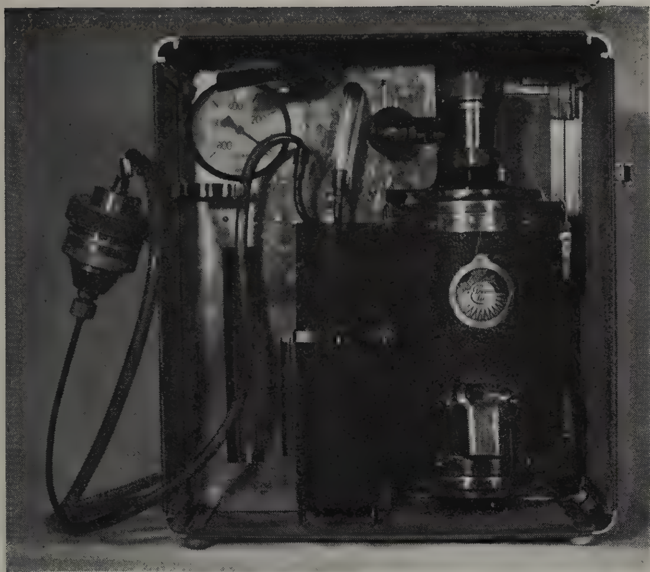


Fig. 5.

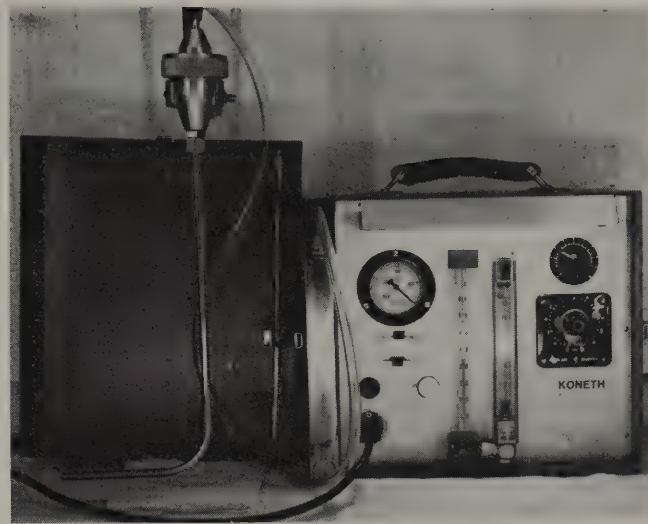


Fig. 6.

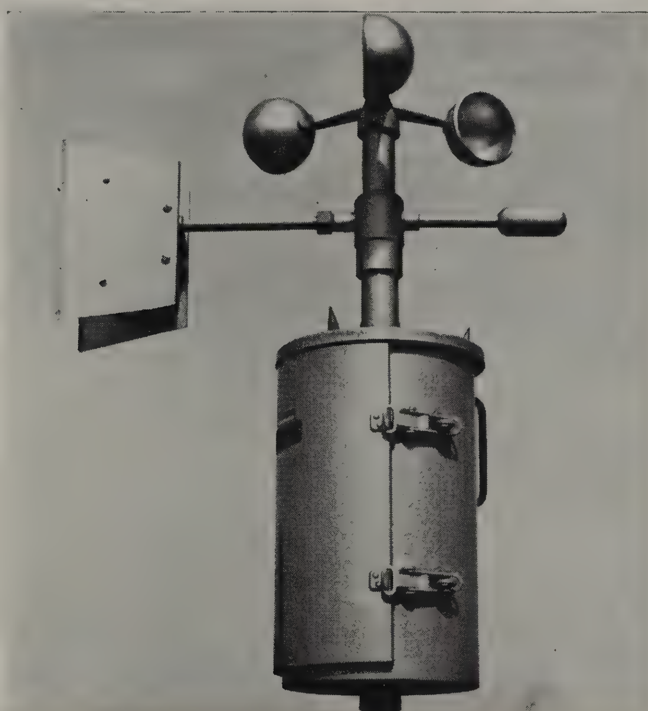


Fig. 7.

Fig. 8.

Fig. 9.

An electric pump is used to remove a certain amount of flue gas from the flue of the oil burner in question; it is then drawn through a filter paper. The resulting blackening of the filter paper is a measurement of the soot content of the flue gases. The evaluation of the blackened filter paper is accomplished with a grey scale. Furthermore, the soot patches may not smell of oil.

This equipment is manufactured by E. Koneth, Bachenbuelach (system: Health Inspectorate of the City of Zürich).

An interesting comparison may be seen in the two following figures. Fig. 5 shows the prototype of the oil-burner testing instrument developed by the Health Inspectorate, while Fig. 6 shows the unit now built in series and available commercially—it is not only smaller, but also considerably lighter.

*Mechanical recording anemometer, Woelfle type**

Of crucial importance in the spreading of air-polluting substances are the prevailing wind conditions. The microclimate must therefore be continually measured at the measurement location, notably wind direction and velocity.

The wind direction is detected by the wind vane. It is moved to the direction the wind is blowing by the effect of the wind pressure. On the other hand, the velocity is measured by a set of cups mounted above the vanes. The effect of the wind pressure causes these to rotate with a rpm which is a function of the wind velocity. The sum of the revolutions is a measurement of the velocity. Both pieces of information are centred mechanically on a recorder strip.

This instrument, which is used in all air-hygienic investigations, is shown in Fig. 7 and is manufactured by Wilhelm Lambrecht KG, Goettingen.

Thermohydrograph

The thermohydrograph serves for recording the temperature and air humidity. Both of these pieces of information are part of the microclimate of the measuring site.

The temperature is indicated by the expansion of a a bimetallic strip and transferred to the recorder device mechanically. The humidity of the air is indicated by the change in length of moisture-sensitive hairs. This value is mechanically recorded as well.

The manufacturers of this equipment are Haenni & Cie. AG., Jegenstorf.

* The instruments marked with an asterisk were generously placed at our disposal by the Federal Commission for Air Hygiene.

Fig. 8 shows the measuring van which has been used for the past 10 years for air-hygienic measurements in the City of Zürich. It is a one-time first aid van, rebuilt for the new purpose. The newer instruments continued to demand more space, however, making it necessary to procure a considerably larger measurement van. This was put into operation on 20 April 1971 and is seen in Fig. 9.

The important points are, the large working space and the fact that it is air conditioned. The very sensitive measuring instruments have to be kept in operation at a constant temperature. Furthermore, the van includes current stabilization as well, since voltage deviations have a very negative effect on the level of discharge of the suction pumps.

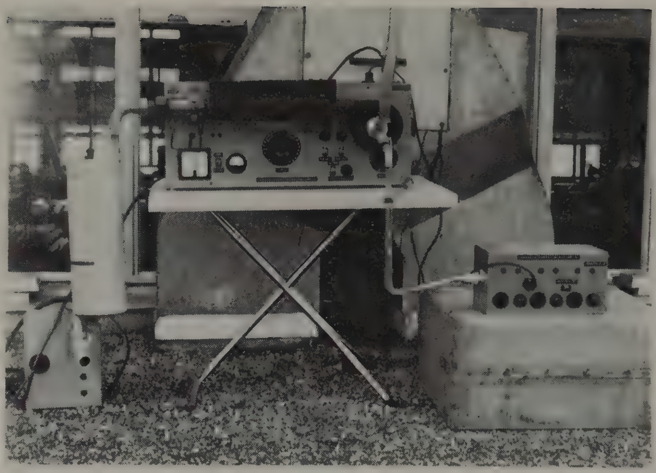


Fig. 10.

Now, in order to permit practical conclusions to be drawn from the measurement results as well, we were forced to develop investigation apparatus to assist industry in solving exhaust-gas problems. Two of the instruments developed by the Health Inspectorate are shown in Fig. 10. These are units used in the elimination of odorous emissions. Their versatile application has already made it possible for us to solve a number of difficult problem for industry.

Conclusion

The activity of the Air Hygiene Laboratory of the Health Inspectorate has shown very advantageous results. On the one hand, a great many people seeking advice have been helped with results of investigations, and on the other, it was possible for us to assist actively in the planning of new installations. Finally, our laboratory was also in a position to supply important data for street planning which gave the responsible experts valuable indications for new or different solutions. One can now only hope that other cities and regions will decide to establish and operate their own air-hygiene laboratories. The experience in Zürich has been thoroughly positive and is certainly worth copying.

Annex

Smoke checks on diesel engines by the full-load method

Limit values:

The following limit values (measurement tolerance included) are valid for an elevation of 600 metres above sea level; for each 400 m of greater elevation, 0·5 should be added to the blackening number.

Piston Displacement	*Blackening number according to Bocsh*
up to 3 lit	6·0
over 3 to 5 lit	5·5
over 5 to 8 lit	5·0
over 8 lit	4·5

In the case of subsequent checks of used vehicles, an addition of one blackening number is allowed.

Smoke checks on diesel engines by the acceleration method

Limit values:

The following limit values (measurement tolerance included) are valid for an elevation of 600 metres above sea level; for each 400 m of greater elevation, 0·5 Bacharch Units should be added.

Piston Displacement	*Bacharach Units*
up to 3 lit	6·5
over 3 to 5 lit	6·0
over 5 to 8 lit	5·5
over 8 lit	5·0

In the case of subsequent checks of used vehicles, an addition of one Bacharach Unit is allowed.

Visual check of exhaust gas

In the monitoring of the vehicles in traffic, a visual check of the exhaust gas can be made as well. Smoke formation which is merely momentary, such as during starting, accelerating, when shifting gears or when the engine brake is switched off, as well as minor gas formation at elevations over 1000 m, can be disregarded.

Carbon monoxide measurements in exhaust from petrol engines

Limit values:

The highest permissible percentage of CO, measured when idling, shall not exceed 4·5 vol. per cent. In the case of vehicles which were put into operation before 1 January 1970, this value may be exceeded if essential to a flawless functioning of the engine. Because of the small margin of error in the measuring instruments, exceeding the permissible maximum value by 1 vol. per cent cannot be objected to.

This summary shows quite dramatically, that it is no doubt possible to carry on an active air-hygiene programme wherever the will to do so is present. This observation has, furthermore, been reinforced by actual experience, and the activity of the Air Hygiene Laboratory of the City of Zürich has proved itself in every respect; there have been a certain number of successes.

AUSTRALIA

One of the factors that is expected to weigh heavily in favour of the eventual introduction of nuclear power stations in Australia is the advantages they have in lessening the problems of pollution associated with power stations using fossil fuels, such as coal.

The Australian Atomic Energy Commission, in its recently published annual report for the 1970-71 financial year, pays some attention to the environmental value of nuclear power generation.

The commission carried out an extensive programme of environmental studies in its preparations for the construction of Australia's first nuclear power station at Jervis Bay in the State of New South Wales.

Planning for the power station, including the assessment of tenders, had reached an advanced stage when the Australian Government decided in June to defer a decision on the power station for a further 12 months for financial reasons.

The commission's report summarises the history of the 500 megawatt project, including some of the research work associated with it.

In a chapter dealing with the environment, the report says that because of population growth and the urge to raise living standards and to expand industry and technology, the demand for energy in industrial countries is doubling every eight to 14 years.

" Extrapolation of the present trend to the end of the century can produce some startling results, such as the possible increase in total world energy demand from about 1,000,000 megawatts in 1970 to 7,000,000 megawatts in 2000."

" In 1968, the power generating industry in the United States alone discharged 24,400,000 tons of oxides of sulphur, 10,000,000 tons of oxides of nitrogen and 8,900,000 tons of particulate matter into the atmosphere, together with many other airborne pollutants.

" If its further energy needs were to be met entirely by burning coal, the United States would need to mine and transport 10,000,000 tons of coal each day by the year 2000.

" Emissions of sulphur and nitrogen oxides could rise to 122,000,000 tons and 50,000,000 tons per annum respectively as a consequence. A similar situation is developing in Australia, although such detailed figures are not available."

The report says that carbon dioxide is not normally considered a pollutant, but concern is growing over the continued emission of this gas and its possible effect on the world's climate.

Since the beginning of the century the average concentration of carbon dioxide in the atmosphere has increased by eight per cent and the present rate of addition (6,000 million tons a year) is increasing at approximately the same rate as the demand for energy.

" Reduction of the pollution and environmental hazard caused by the effluents of coal and oil burning is technically possible in many cases (to a limited extent) but it involves considerable effort, expense and consumption of still more energy. This is a vicious circle which requires to be broken."

The report says that the world's resources of fossil fuel also are limited and irreplaceable and in the near future may be regarded as invaluable chemical raw materials.

" Nuclear energy offers a solution to many of these problems. It is a clean source of energy which results in no emission of carbon dioxide, sulphur dioxide, oxides of nitrogen, toxic hydrocarbons or fly ash.

" With proper regulation nuclear power stations present no hazard to the environment or to human health.

" They are not expected to displace coal and oil burning stations, but rather to offer a complementary source of energy production. By the end of the century, nuclear power may well be supplying half the world's needs, the remainder coming from coal, oil, natural gas and hydropower."

The report discusses the methods available for the safe handling of radioactive by-products produced by nuclear power generation. It says that the nuclear industry has been policed from its inception and all its waste products have been checked and disposed of under formal approvals.

Low-level radioactive discharges are permitted to be released into the environment only at levels that comply with national and international health standards.

ITALY

ANTINQUINAMENTO '71—Milan Fair, 14-19 November, 1971

It was early in 1970 that the Society was approached by Lintex Limited and N.I.F.E.S. with a request to organise an international conference on pollution to be held in Milan in 1971. After considerable negotiations it was agreed that the Society would go ahead with the project provided that all expenses were guaranteed and that any profits from the conference should come to the Society. There was then a period of inactivity because the exact date of the conference could not be fixed as a license for the accompanying exhibition was required from the Italian government.

However, early in 1971, Lintex Limited came to an agreement with COMIS of Milan to go ahead and the conference was planned for November, 1971. This left very little time to collect together the necessary speakers on all types of pollution from many different countries, especially as we had the postal strike in this country. However, by persuading visitors to the Continent to post mail over there, we were able to get in touch with the various speakers and a programme was gradually drawn up. The original difficulty was the obtaining of the right number of speakers and keeping a fair balance between the various nationalities. Later, as the conference was advertised and became known on the Continent, it was necessary to exercise tact to restrict the number of papers that were being submitted, especially from industrial sources, and to revise the programme a number of times before the conference actually opened on Monday, 15 November, 1971. The requirements of COMIS, who were promoting the exhibition and backing the Conference, also had to be taken into account and these were apt to change rapidly and unexpectedly.

Great difficulty was experienced in obtaining manuscripts of their papers from the Italian authors: as these had to be translated into English and then issued as preprints to delegates, adherence to an agreed date was essential, but in spite of the expenditure of a great deal of effort and time—to say nothing of money—on letters, cables and telephone calls, these papers were late and English translations to delegates were not available when the conference opened.

The conference was opened by Professor F. L. Petrilli, the Director of the Institute of Hygiene of the University of Genoa, who gave a very stirring address on global pollution and its effects on human health. The Opening Session was very well attended and it was estimated that there were about between 350 and 400 delegates. The Monday afternoon was given over to exhibitors who were allowed to present short papers on their products and the way in which these contributed to the control of pollution.

On the Tuesday the technical conference really got under way with both the morning and afternoon sessions being utilized for scene setting in which speakers gave a review of the conditions pertaining in their own countries in Europe. Dr. Sergio Pampuro gave the Italian viewpoint. Mr A. I. Biggs of the Confederation of British Industries spoke on behalf of Great Britain and Professor Garnier reviewed the current situation in France. Dr L. Bruneau of Sweden spoke on behalf of all the Scandinavian countries and Dr. W. Gassler gave the German viewpoint. Striking a more international note, Mr. W. C. Hopper of Stichting Concawe gave a wider viewpoint and Dr. Virginio Bettini of Italy spoke on the ideas of the World Health Organisation. The Wednesday morning session dealt with pollution of the land and papers were given by Dr D. H. Sharp of the United Kingdom, Dr Fresenius of Germany and Dr. Blokker of Stichting Concawe. In the afternoon under the Chairmanship of Professor Richards of Loughborough University, noise was considered and papers were presented by Mr Ariel Alexandre of France, Professor G. G. Sacerdote of Italy and Dr. J. A. Langdon of the Department of the Environment of the United Kingdom. The attendance at these two sessions was rather disappointing.

On Thursday morning water pollution was considered and papers were presented by Dr. B. A. Southgate, the former Director of Water Pollution Research in Great Britain, Dr J. L. Blanc of Techfina, Switzerland, Professor P. Berbenni of Italy and Dr. Giorio Pascarella of Italy. In the afternoon air pollution and its control was discussed in papers by Mr. F. E. Ireland, Her Majesty's Chief Alkali Inspector, Mr A. Sverdrup of Norway, Mr. L. Angyan of Hungary, Ing. L. Erizzo, Ing. L. Rigutina, Professor M. Colombini and Professor E. De F. Frangipane of Italay.

In the event, these two sessions turned out to be the most popular and aroused the most interest. On each occasion there were good attendances and it was a pity in each case that more time was not available for discussion. This was especially so during the afternoon session when the Chairman allowed "Commercials" to creep in and take up valuable time.

On the Friday morning under the Chairmanship of Sir Kenneth Hutchison, the Immediate Past President of the Society, pollution of the sea was considered. Papers were presented by Professor R. B. Clark of the University of Newcastle upon Tyne, Ing. R. V. Romano of Mobil Oil Italiana, A. L. Galli of B.P. Italiana and Professor Deglia of Italy. The closing session followed; this took the form of general discussion under the Chairmanship of Professor G. A. Canaperia of Rome who was the overall President of the conference. This proved a most interesting session in which pollution was considered right across the board in all its forms, internationally. Here again it was unfortunate that more time was not available for what turned out to be extremely lively discussion.

It may be said that the conference, although a worthwhile venture, enjoyed limited success. A bigger overall attendance would have helped for one thing, and for another, although the simultaneous translation in itself was good, it would have been much better if more earphones—which always worked—had been provided by the Italian organisers, as promised. There certainly were failures in organisation caused by divided control, but most delegates seem to have reckoned that their visit to Milan was worthwhile. Certainly the Italian delegates thought so.

The exhibition, which was of a truly international character, occupied the entire ground floor of Palazzo 7 at the Milan Fair. COMIS, the Italian organisers, worked well to produce a good attendance, although this might have been better if more information regarding exhibitors had been made available to the international press in advance.

The British Joint Venture stand, which was organised by the Society in conjunction with the Department of Trade and Industry, attracted a great deal of attention. The exhibitors who participated in the Joint Venture Stand were: F. E. Beaumont Ltd., The British Consultants Bureau, Effluent Control International Ltd., Fleming Instruments Ltd., Glass Developments Ltd., Satec Ltd., Steam Vacuum Extraction Ltd., Tilghman Wheelabrator Ltd., Warren Spring Laboratory and the Society who had an information stand.

All exhibitors were well patronised and all considered that they had had a successful time at the exhibition. Many useful enquiries were received which could lead to business in the future.

Rather naturally, most visitors came from Italy. Great interest was displayed in what the United Kingdom had achieved in the control of air pollution and water pollution, greater interest, if anything, being displayed in the means of controlling water pollution. Those exhibitors therefore who produced equipment for this were kept extremely busy. The British Consultants Bureau stand, which was to some extent a new departure, was also fully occupied dealing with enquiries of a technical nature.

The Society's stand received very many enquiries on air pollution and our literature was in great demand.

There have been criticisms that the exhibition could have been larger; for that matter any exhibition can. As regards scope, the British exhibitors themselves thought it was quite wide enough.

SWEDEN

Comments on different air protection policies concerning emissions of sulphur compounds

By

Göran Persson, Dr. Head of Division

Bo Assarsson, Engineer, Head of Section

Air Protection Division, National Swedish Environment Protection Board

Introduction

The effects of the emissions of sulphur compounds are widely discussed in Scandinavia at present and measures are being taken to restrict those emissions. Because air pollution knows no frontiers, international action is required. In this paper the different effects of sulphur in air and precipitation and their different implications for air pollution policies are discussed. The Swedish policy for abatement of effects of sulphur compounds is also summarised.

Effect of sulphur in air and precipitation

There are in principle two different types of damage caused by sulphur in the air. The first type is due to the direct effects of sulphur dioxide in the air and is therefore dependent on the concentration of pollutants in the air. Direct effects to human health, vegetation and material of sulphur dioxide in the air are limited to a distance of a few kilometres from the source.

The second type is due to the quantities of sulphuric acid deposited on the ground and the following change in the content of nutrients in the soil and the acidity of the water. This affects the flora and fauna and is largely dependent on the accumulated total deposit of acid. These effects may be felt far from the source. On average, sulphur is transported more than 1000 kilometres before it is deposited on the ground.

Direct effects of sulphur dioxide in the air

The direct effects of sulphur dioxide in the air to human health were considered when recommended values of tolerable concentration were established in Sweden 1964. They are evident from the following table.

Swedish recommended values for SO_2 concentration

Average during	*Concentration (ppm)*	*Remark*
1 month	0·05	Should not be exceeded
1 day	0·10	Should not be exceeded more than once every month
30 min	0·25	Should not be exceeded more than 15 times every month

1 ppm = 1 part per million by volume

Damage is caused to material and vegetation at lower concentrations, down to between 0·01 and 0·02 ppm for long periods of time.

Effects of deposition of sulphuric acid

Deposition of sulphuric acid may cause damage to arable land, forests, lakes and rivers. The following presentation is based on Sweden's case study contribution* to the UN Conference on the Human Environment. Effects by acid precipitation are dependent on the sensitivity of the soil measured by the degree of base saturation. (The amount of cat ions adsorbed to soil particles as percentage of what totally can be adsorbed.) The Scandinavian coastal zone facing Central Europe is very susceptible to deposition of sulphuric acid.

The present deposition causes probably little damage to arable land and it is possible to compensate the acidity by an increased use of lime in fertilizers. To assess the possible damage to forests a known relation between the amount of calcium in top soil and productivity of forests has been used.

Since deposition of sulphuric acid soaks calcium out of the soil a reduction of the forest productivity can be expected. Based on historical data an estimate of the decrease of productivity over the last 20 years has been carried out. An annual rate of growth reduction amounting to 0·3 per cent would probably be of the right order of magnitude. This means that the yearly growth until year 2000 would be reduced by 10-12 per cent compared to the absence of acid deposition.

Comparisons of the pH values for a number of rivers and lakes investigated at intervals of between 10 to 40 years have shown beyond doubt that the pH values in the South-Western parts of Sweden has fallen during the last few decades. A separation of the present data into classes according to the drop in pH value over 5 years is seen in the following table. This shows that not one of the rivers has recorded an increased pH value since the present investigation period began.

Change in the acidity of 15 Swedish rivers system from 1965 to 1970

Change in pH over 5 years Drop in pH-units	*Number of rivers within each class*
Less than 0·1	1
0·1–0·2	5
0·2–0·3	4
0·3–0·4	4
More than 0·4	1

Of course, there are great uncertainties in extrapolating the present trends for the purpose of finding an answer to the question of how long it takes for a river to become acidified to such an extent that fishing will be interfered with more generally. Assuming that the present trends continue unchanged and that the 15 rivers examined can be regarded as typical of the water systems in Sweden, then within about 50 years, the situation of one-half of Sweden's rivers will become critical from a biological point of view.

The report mentioned above also deals with the residence time of sulphur in the atmosphere. The result of the estimate of the distributions between various sources is summarized in the following table.

Distributions between various sources of sulphur deposited over Sweden

(unit 100 mg sulphur/m² per year)

	The deposit from natural back-ground	*Deposits caused by Swedish emissions*	*Deposits caused by emmissions from adjacent regions of Europe*	*Total*
Southern Sweden	2·5	1·5	5·0	9·0
Northern Sweden	2·5	0·8	2·5	5·8

Implications for air protection policies

The two different types of effects have different implications for air protection policies. If the direct effects of sulphur dioxide in the air would be in sole control and the total emission of sulphur oxides could be neglected, measures to reduce ground level concentrations of air pollutants could be taken at a relatively low cost. These measures would involve the use of tall chimneys, centralized heating in urban areas, low polluting fuels e.g. electricity, gas and low sulphur distillates where centralized heating is unpractical and finally improved combustion equipment or arrestors to reduce the emissions of particulate matter. These measures would probably imply an increase of the total emissions of sulphur dioxides, but give an acceptable air quality with regard to the recommended concentrations of sulphur dioxide.

However, the total emissions of sulphur oxides are of great importance to the environment if effects of deposition of sulphuric acid are taken into consideration. As shown above, these effects are of great significance at least in Scandinavia and represent a considerable economic value beside the losses in the quality of the environment. If these accumulating effects should be reduced to a less objectionable level the total emissions of sulphur oxides should be reduced compared with the present situation.

The implications for air protection policies by the recognition of these deposition effects are that a realistic compromise about the necessity and possibility of reducing the sulphur oxides emissions must be agreed to. The technical possibilities and costs of desulphurization are of great importance in this context. In spite of the great development work carried out in this field it must be recognized that the possibilities of reducing the sulphur oxides emissions are limited at present. One feasible alternative appears to be the installation of maximum gas oil and vacuum gas oil desulphurization at oil refineries. Using this available technique to a maximum extent the sulphur content of heavy fuel oil in Western Europe could be reduced to 1·0 per cent by weight, provided the supply of 30-40 per cent low sulphur crude oil that is expected.

This possible reduction of fuel oil sulphur content gives an opportunity of reducing the emissions from fuel oil burning in Western Europe of 1980 to the 1970 level. It can also be expected that development work will produce economic possibilities to desulphurize residual oil and combustion gases from such oil within a limited number of years giving possibilities of a further reduction of the emissions.

As regards emissions of sulphur oxides from coal burning the possibilities of fuel substitution, combustion gas desulphurization and coal cleaning should be developed and used to an extent where costs are comparable to those of fuel oil desulphurization. Costs should be calculated on the amount sulphur prevented from polluting the air.

The Swedish air protection policy

The deposition effects of sulphuric acid are recognized in Sweden and influence the air protection policy. Basically a combination of both policies described above is used. Concentrations and effects of sulphur dioxide in the air are being reduced to a sufficiently low level compared with recommended values. This is accomplished by the different methods first mentioned above. The heights of chimneys are calculated from the actual emission of sulphur dioxides.

On the other hand the recognition of the deposition problems has given the conclusion that the total emissions of sulphur oxides must be reduced. Since no coal burning of any significance exists in Sweden, a successive reduction of fuel oil sulphur content to maximum 1·0 per cent during the seventies reduces the sulphur oxides emissions of 1980 to the 1970 level. As is mentioned above this can be done by using available technique. Flue gas and residual desulphurization might be preferred in some cases. The successive reduction of fuel oil sulphur content is accomplished by extension of present areas with restriction of fuel oil sulphur content to 1·0 per cent. The restrictions are initially realized in areas where local effects can be simultaneously reduced. This is one result of the combination of policies.

Reference:

* Air pollution across national boundaries. The impact on the environment of sulphur in air and precipitation. Royal Ministry for Foreign Affairs. Stockholm 1971.

DENMARK

In the Danish budget for 1971/72 the Ministry for Combating Pollution have been allotted a sum of Dkr 12 million and tentatively for 1972/73 a sum of Dkr 25·1 million.

The Minister for Pollution, Mr. Jens Kampmann, has laid before the Folketing (Danish Parliament) a bill relating to the sulphur content of heating oils, and the lead content in petrol. The relevant figures are that from 1 October 1972 the contents of sulphur in heating oil must not exceed 0·8%; from 1 January 1973 heavy fuel oil must not contain more than 2·5% sulphur; from 1 November 1973 heavy fuel oil in the Copenhagen and Frederiksberg communes and the Copenhagen county commune must not contain more than 1% sulphur during the period 1 November-31 March; and, the permissible limit for lead content in petrol will be reduced from 8·4 g per litre to 4-5 g.

FRANCE

In the Gare de Lyon area of Paris an experiment is taking place with two, 15 ft tall, cylinder type, vacuum cleaners which have been placed at either end of a street in the hope that they will clean up the air. Polluted air is sucked in by means of huge fans.

City officials say that they will filter out 80 pounds of pollutants a year. If the experiment is a success more of these vacuum cleaners will be built.

IUAPPA

Third International Clean Air Congress

Call for Papers

The 3rd International Clean Air Congress will be held at the Congress Centre, Neue Messe, Dusseldorf, West Germany, from the **27th-31st August, 1973.**

The Chairman of the International Programme Committee has asked for the submission of papers to be presented at this Congress. Abstracts of proposed papers, which should not exceed 200 words, from British authors are required to reach the Director of the National Society for Clean Air by **30th June, 1972.** Subjects to be covered are:

1 **Principal Subjects**

1.1 Means and technical methods for the reduction of air pollution in heavily polluted regions.

1.2 Ways of controlling air pollution in new plants (including design of technical and administrative regulations).

1.3 Clean air through new technologies (pollution-free plants, harmless raw materials and products).

1.4 Education and training; public relations.

2 **Profile Subjects**

2.1 Influence of meterrological factors on air pollution.

2.2 Physics and chemistry of atmospheric pollutants.

2.3.1 Criteria for the determination of the effects of air pollution (effects on health, animals, vegetation and materials).

2.3.2 Air quality criteria and standards.

2.4 New systems of measurements (emission and environment).

2.5 State of differing national legislation: the technical and economic consequences resulting therefrom.

2.6 Role of fiscal policies and taxation in fighting air pollution.

2.7 Clean air through regional and urban planning.

3 **Branch Subjects**

3.1 Combustion for domestic heating and industries.

3.2 Combustion in power stations.

3.3 Air pollution from road vehicles and aircraft.

3.4 Mining (including processing, e.g. coking plants, briquette factories).

3.5 Cement, lime, brick and ceramic industries and building techniques.

3.6 Iron and steel industry, non-ferrous metal smelters, re-melting works, foundries.

3.7 Chemical industry.

3.8 Petrochemical industry, refineries.

3.9 Agriculture and animal husbandry.

3.10 Waste disposal and recovery.

Further details and application forms may be obtained from the Director, National Society for Clean Air, 134/137 North Street, Brighton BN1 1RG.

Full information about the Congress will be promulgated in future issues of this journal.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BOOK REVIEWS

Annual Report of the Scientific Adviser
Greater London Council, 1970. £1·20 (postage extra).

As usual, this is a very comprehensive report, summarising the work of the Scientific Branch of the Greater London Council during 1970. It is divided into six main parts: Water pollution, sewage treatment and waste disposal; Building materials for construction and maintenance; Environmental studies; Statutory; General supplies and services and General.

In Environmental Studies there is a section devoted to air pollution. The Scientific Branch has continued its long-standing programme of routine measurements of smoke (black suspended particulate matter) and gaseous sulphur dioxide in London's air, as a contribution to the National Survey of Air Pollution. The Survey requires the maintenance according to BS1747 of volumetric instruments which are used to measure the daily average concentration of each pollutant. Twelve of these instruments were maintained during 1970. The results were submitted to the Warren Spring Laboratory for collation and publication, and the average is also published in the Annual Abstracts of Greater London Statistics.

The use of the lead dioxide instrument, for the measurement of the monthly average rate of absorption of sulphur compounds on a reactive surface of lead dioxide, was continued for a further year, but the Report says that the importance of this method is waning. The Branch maintained eleven such instruments and gave analytical assistance with another.

Dust and grit fall were monitored by means of the Standard British deposit gauge (BS1747). During 1970 the Branch maintained four deposit gauges and undertook the analysis of samples from a further six on behalf of other authorities. A study of the available data on dust and grit fall has revealed that the number of deposit gauges maintained in London have for many years been insufficient to indicate the trend of this form of pollution. To ascertain whether there has been any reduction since the Clean Air Acts of 1956 and 1968 it is intended during the coming year that additional instruments will be established by the Branch on former sites for which data from earlier years is on record. A new instrument, the directional dust gauge developed at the Central Electricity Research Laboratories, is being considered for the monitoring of dust nuisance. It is not expected, however, that it will yield results which could be validly compared with results obtained earlier by the deposit gauge. The Branch had five directional dust gauges in operation during 1970.

The results obtained by means of daily volumetric instruments maintained by the Council at seven representative sites in Inner London indicated a continuing decline in the pollution of the air by smoke and sulphur dioxide. The yearly average concentration of smoke measured during 1970 was 47 microgrammes per cubic metre of air. This indicated a reduction of 8 per cent on the figures for 1969. The yearly average on sulphur dioxide concentration measured during 1970 was 144 microgrammes per cubic metre, which was 10 per cent less than in 1969. The highest local 24-hour average concentrations recorded during the year were 333 microgrammes of smoke and 720 microgrammes of sulphur dioxide per cubic metre of air.

The Report states that two events during the year promoted fears of a temporary set-back in smoke control. The first was a shortage of authorised solid fuel, which necessitated the suspension of many Smoke Control Orders, affecting 40 per cent of the premises normally covered by the Orders in 14 London Boroughs. No significant effect on general smoke concentrations in London was discernible at G.L.C. monitoring sites, however, although the Report says that there may have been local effects. The second event was the prolonged strike by municipal employees, which led to the widespread burning of household refuse on open bonfires. The palls of smoke which resulted during still weather were visible and irritant, yet there was little apparent effect on the measured smoke concentration. The Report explains that because bonfire smoke is not black like coal smoke it largely escapes detection by the standard method which depends upon the degree of blackening of a white filter paper through which the air is drawn.

A detailed report on the trends of air pollution in the Greater London area, prepared by the staff of the Warren Spring Laboratory, was issued during the year. The Report states that no other region of the country has shown as great a proportional decrease of pollution by smoke as London. At 31 March 1971 the percentage of total black area premises in Greater London covered by smoke control orders confirmed or awaiting decision, was 82 per cent. In regard to sulphur dioxide, however, it seems that up to 1969 the decrease of concentration was less than the average for the country. The Report hopes that the progressive reduction of sulphur dioxide concentration which in London only began in 1965 will be maintained.

The Branch co-operated with a team of American investigators from the National Air Pollution Control Administration in a six-month survey of particulate matter in air. The purpose of the exercise was to establish a relationship between American and British methods of measurement in order that epidemiological studies in the two countries could be co-ordinated.

The Report gives details of measurements and investigations into grit and dust; acid smuts; vehicle fumes; leaded petrol and ventilation of vehicular tunnels. Quite a large section is also devoted to noise.

Christine Smith

Reader Enquiry Service No. **725**

Redland Guide to the Construction Industry, 1972
Redland Ltd. £2·00.

This annual reference work, in its second year of publication, is a guide to the recommendations, regulations and statutory and advisory bodies of the construction industry.

The Guide contains 365 pages of information in three sections: "Directory", "Digest" and "Special Feature". The Directory lists Government Departments; Professional Associations; Preservation and Conservation Societies; Trade Associations; Trade Unions; Research Bodies; Information Services and Local Authorities, together with address, brief summaries of their work and aims and any publications they produce.

The Digest includes summaries of major Reports on Construction and Planning, including The Clean Air Acts of 1956 and 1968; Industrial Relations Act of 1971; Local Government Reform and Fire Precautions Act of 1971. The special feature is on the present position of Building Regulations.

Altogether a very useful reference book.

Reader Enquiry Service No. **727**

This Dirty World
Ronald C. Denney. Nelson, 1971. £2·50.

This is a very readable book, concerned with showing how we all contribute to the deterioration of the environment and how the problems which have been created are now being dealt with. At the same time it indicates where attention, research and legislation need to be concentrated, so that future improvements in the environment can be achieved.

Because this is such a vast subject, the author cannot go into great detail and unfortunately, when he describes the provisions of the Clean Air Act his facts are rather muddled, giving the impression that industrial premises in smoke control areas are permitted to produce dark smoke for limited periods.

Otherwise, an interesting book, giving brief but balanced accounts of all the various aspects of this "Dirty world", and, unlike most books of this nature, a fairly hopeful outlook for the future.

The appendix gives addresses of organisations concerned with the environment. The National Society for Clean Air is listed, but unfortunately with the old London address. A useful list of recommended reading concludes the book.

Reader Enquiry Service No. **728**

Air Pollution Control, Part I
Edited by Werner Strauss. 451 + ix pp. Wiley-Interscience, London, 1971. Price £9·50.

Dr. Werner Strauss, editor of the book, is head of the Department of Industrial Science of the University of Melbourne, Australia. The book contains seven articles on (i) Dispersion of Pollutants Emitted into the Atmosphere, (ii) Formation and Control of Oxides of Nitrogen, (iii) Control of Sulphur Emissions from Combustion, (iv) Control of Internal Combustion Engines, (v) Electrostatic Precipitation, (vi) Collection of Particles by Fiber Filters, and (vii) Condensation Effects in Scrubbers. Three of the articles, (ii), (iii) and (vii) are by authors at the University of Melbourne, two, (i) and (v), by authors in the U.S.A., one, (iv) from an author at the University of Aston, England, and one, (vi), by an author at the University of Karlsruhe, Germany. At the end of each article, there is a useful list of references to the appropriate literature.

The book, which is well produced, is of interest mainly to specialists, particularly to those planning research in the particular aspects covered by the articles.

A. Parker

Reader Enquiry Service No. **729**

World Meteorological Organization. Air Pollutants, Meteorology, and Plant Injury

By E. I. Mukammal, C. S. Brandt, R. Neuwirth, D. H. Pack and W. C. Swinbank. (Members of the Working Group on Plant Injury and Reduction of Yield by Non-radioactive Air Pollutants of the Commission for Agricultural Meteorology.). Technical Note No. 96, 1968.

Plant life is greatly influenced by a number of air contaminants, some of which may be present in the atmosphere in relatively low concentration. The susceptibility of different species and even different varieties of one species of plants may vary considerably. However, surveys have shown that the economic losses, both direct and indirect, caused by air pollution injury to agriculture are extensive and increasing in many parts of the world. This report reviews the problem and the present state of knowledge in order to assist meteorologists and others concerned in seeking means of preventing or of controlling the extent of such injury.

The first two sections review the establishment of the working group, its membership and methods of work, and describe the general nature of the problem to be studied.

Section three examines in details the sources of the various contaminants and their chemical reactions in a contaminated atmosphere. Section four describes the variations in the susceptibility of plants to air pollution damage as related to meteorological and other factors in plant environment. These factors, many of which exert their influence through their effect on stomatal movement, include light, nutrition, exposure relative humidity, and temperature. Section five discusses the recognizable symptoms of air pollution injury, giving suggestions for identifying the causative agent and for recognising similar symptoms produced by their disorders.

Section six, which constitutes nearly half of the report, is concerned with air pollution meteorology. It states that knowledge of the atmosphere's ability to transport and dilute contaminants cannot be applied to air pollution problems without concurrent consideration of pollutant emissions and the biological sensitivity and response charcteristics of specific plants. Sub-sections are devoted to the effects of surface configuration on diffusion, to vertical and horizontal turbulent diffusion, to atmospheric transport, and to research problems. These are followed by other sub-sections on the several aspects of meteorological applications to air pollution problems. The final sub-section reviews present and possible future programmes in the prediction of pollutant concentrations, air pollution potential, and pollution damage.

Section seven outlines the general principles involved in collecting and analysing air samples to determine the nature and concentration of pollutants. Section eight discusses control measures and section nine briefly summarises the general situation.

An extensive bibliography, Section 10, concludes the report.

Reader Enquiry Service No. **7210**

Britain's Natural Gas

This new gas Council publication tells the story of North Sea natural gas. The colourful 50-page booklet traces the history of natural gas telling how the presence of natural gas under the North Sea was suspected, investigated and finally confirmed. Drilling processes, the laying of undersea pipelines and the roles of the gas terminals are looked at in detail. Aspects of control, distribution, storage and land pipelines are also covered.

Reader Enquiry Service No. **7211**

Scientific Design of Exhaust and Intake Systems (Third Edition)

Philip H. Smith & John C. Morrison. G. T. Foulis & Co. Ltd. £3·65.

Review by P. Draper, C.Eng.

This book is mainly concerned with the difficult problems of designs for inlet and exhaust manifold and silencers for multi-cylinder automotive engines and would be a useful reference book for engine designers and developers.

This new edition includes a chapter (14) on exhaust pollution control which refers briefly to the pollution problem, formation of pollutants and their measurement. It then discusses the two methods of pollution control, the first improving combustion within the cylinders and second, the afterburning in the exhaust system.

There is a good description of the Zenith Stromberg Pollution Control Carburetter, with and without duplex manifolding.

Reference is made to means of controlling high temperature combustion which is responsible for the fixation of oxides of nitrogen.

Some reactor manifolds and catalytic converters in the exhaust system are briefly described.

Regarding the future developments, the book observes that European requirements are likely to be met, but the exaggerated U.S. Federal controls for 1976 may well mean changes in engine design or fuels used.

P. Draper

Reader Enquiry Service No. **7212**

New additions to the National Society for Clean Air Library, available on loan

J. Parker. Air Pollution at Heathrow Airport, London: April-September, 1970. Reprint from SAE/DOT Conference on Aircraft and Environment, P-37-Part I by Society of Automotive Engineers, New York.

S. R. Craxford, M-L P. M. Weatherley and B. D. Gooriah. Trends in Ground Level Concentrations of Pollutants in the Ambient Atmosphere. Paper to the Society of Environmental Engineers, Olympia, London, June, 1971.

S. R. Craxford and M-L. P. M. Weatherley. Dispersal of Airborne Effluents—Air Pollution in Towns in the United Kingdom. Reprint from Phil. Trans. Roy. Soc. London, 1971.

D. J. Garrod. A Survey of Measurement and Control of Pollutants. Paper given to the Institute of Measurement and Control Symposium, 1971.

Préfecture de Police: Secrétariat Général: Paris. Études de Pollution Atmosphérique a Paris et dans les Départments Périphériques en 1970.
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Ralph I. Larsen. A Mathematical Model for Relating Air Quality Measurements to Air Quality Standards. U.S. Environmental Protection Agency. Office of Air Programs Publication No. AP-89, 1971.

World Meteorological Organization. Meteorological Aspects of Air Pollution. Technical Note No. 106. 1970.

World Meteorological Organization. Meteorological Factors in Air Pollution. Technical Note No. 114. 1970.

World Meteorological Organization. Air Pollutants, Meteorology, and Plant Injury. Technical Note No. 96. 1968.

LETTERS

The Editor,
Clean Air
Sir,

The fact that J. H. Asberry, whose letter you published in the Winter edition of Clean Air, is obviously interested in the subject is the only thing which prevents me from condemning him out of hand. His claim that open fires drawing through a back boiler are virtually smokeless is, in my opinion, not true. Many back boiler flues draw almost all their air requirements from below the grate and only marginally affect the amount of smoke produced when "green coal" is introduced to the fire.

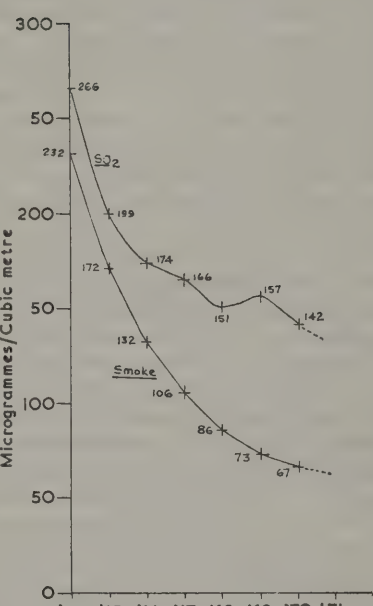
A secondary burning zone must be provided, as on the N.C.B. developed fire, to make any sense out of domestic coal burning.

One thing about smoke control is that it can be seen to be working by anyone who has lived in the same area "before" and "after" smoke control orders have become operational.

The whole of our small Urban District is now smoke controlled and the results are exceptionally encouraging. Perhaps the graph attached could convince recalcitrant local authorities in the "black areas" that they should get on with the job they ought to have started years ago.

Yours faithfully,
G. R. MILLINGTON
Public Health Inspector

Town Hall,
Horbury.



AVERAGE VALUES OF SMOKE AND SULPHUR DIOXIDE 1964 — 1970

The Editor,
Clean Air
Sir,

May I attempt to reply to Mr Asberry's letter published in your last number? Whether he agrees with it or not, Section II of the Act of 1956 says "No Smoke" and means it! "Very little smoke" multiplied by thousands equals a great deal of smoke—and Londoners over twenty know to their cost what that means.

While on the subject of burning bituminous coal, I was concerned to see the description of the "new" fuel called "Housewarm" to be marketed by the National Coal Board for use on the new Parkray "Coalmaster". In the Parkray brochure, "Housewarm" is described as "so clean" and delivered in a "brand new way" (in bags!). Nowhere in the description is the dirty word "coal" used and it must surely be only a matter of time before we find it being burned on open and closed fires and boilers in smoke control areas in contravention.

It will then only be a matter of time before distributors handling this fuel will be prosecuted for delivering it for sale.

Yours faithfully,
R. NEWTON
Senior Public Health Inspector (Smoke)

Town Hall Parade,
Brixton Hill,
London.

OPEN MEETING AND LUNCHEON

London, Friday 2nd June, 1972

OPEN MEETING

At 12.30 p.m. immediately after the Annual General Meeting of the Society (about which a separate notification will be made to members) there will be held, at the Connaught Rooms, Great Queen Street, London W.C.2, a Public Meeting to be addressed by:—

The Rt. Hon, PETER WALKER P.C., M.B.E., M.P.
The Secretary of State for the Environment.

LUNCHEON

Following the Meeting the Society's Annual Luncheon will be held at the Connaught Rooms; Mr. Peter Walker will be the Principal Guest. The President, Mr. Stanley E. Cohen C.B.E. will be in the Chair.

Members are invited to bring friends with them to the luncheon, tickets for which will be reserved on receipt of the completed application form below. The price per ticket is £2.50 inclusive of gratuities.

P.G. SHARP
Director.

The Director,
National Society for Clean Air,
134/137 North Street,
Brighton BN1 1RG

Please reserve and forward in due course.........ticket/s for the Luncheon on 2nd June, 1972 for which I enclose £2.50 per ticket. (Cheques to be made payable to the Society).

Signed .... Date ....

Name ....
(Block letters please)

Address ....
(Block letters please)

....

Binders For "Clean Air"

Suitable binders for two volumes of "Clean Air" i.e. eight issues, can be made available to Members and other subscribers if sufficient demand is shown.

If, as is stated above, sufficient demand is forthcoming, the binders would cost £1.10 each including postage and packing.

Please complete the slip below and return it to the National Society for Clean Air if you are interested in purchasing binders for "Clean Air."

National Society for Clean Air,
134-137 North Street,
Brighton BN1 1RG

I am interested in purchasing binders for "Clean Air" at £1.10.

Name ....

Address ....

AIR POLLUTION ABSTRACTS

1263 Air Pollution Practice in the U.K. Steelmaking Industry. Johnson, D. (Iron and Steel, 44(6) Dec. 1971). The Steel Industry in the UK has practised air pollution control on various processes for many years. Much experience has been gained with a variety of plant. This article discusses some of the problems encountered.

1264 Electrostatic Precipitators Tackle Air Pollutants. Oglesby, S. (Environ. Science and Tech. 5(9) Sept. 1971). Advances in electrostatic precipitator technology within recent years have been primarily in specific dust control problems as opposed to radical changes in the equipment itself. Demands for reduced stack emissions have resulted in the necessity for better characterization of emissions from various processes, and especially for designs that will more reliably control emissions to meet more stringent standards. These trends are forcing a shift in precipitator design emphasis toward a more rational engineering approach, with less reliance on design by analogy alone and less use of minimal designs. The ultimate user is faced with meeting the new air pollution codes, and consequently is insisting on control equipment that can be relied on to meet these more severe emission requirements. Problems with each type of dust control equipment differ for each application because of variations in dust and gas properties. Consesequently, specific procedures for designing and operating precipitators apply to a particular industry or application.

1265 New Attitudes to Air Pollution—The Technical Basis of Control. Scorer, R. S. (Atmos. Environ. 5(II) Nov. 1971). Technical knowledge is needed to establish priorities for action. It is important to survey each situation to discover which of the practicable means available will be most effective, and a procedure for conducting the survey is indicated in an example—the basis of the 1956 U.K. Clean Air Act is examined. The technical knowledge needed lies as much in the fields of Local Authority administration, economics, and public relations, as in technology and pure science, and a more effective dialogue is needed between politicians and those working in scientific fields. This dialogue requires personal contact and a more widespread proficiency in the art of briefing and convincing the critical layman on both sides. After considering legislative and other methods, control by practitioners (like the Alkali Inspectorate) is recommended in preference to enforcement through the courts. Admittedly it is consideration mainly of British air pollution problems that leads to this conclusion and it is recognised that technical details of a legal, geographical, economic, social or historical origin may make different methods appropriate in other countries. Costing, and control by fiscal methods are not likely to be effective. At the international level water pollution is far more serious than air pollution, which must not be relieved by creating more water pollution. Some of the outstanding air pollution problems are considered. The most important is car exhaust, and clean exhaust zones are recommended in preference to country-wide restrictions. Globally the two greatest problems are the increase in CO_2 and the production of particulate haze: these work to change the climate in opposite directions. The pressure for economic growth in the most advanced countries conflicts with the preservation of the environment. Already the richest nations make more than a fair share of pollution, for the result would be catastrophic if every person made as much, on the average, as the average in the richest countries. This fact alone means that economic forces which direct the development of our society must be changed, and to make this possible many of our conventions and social criteria need to be modified.

1266 A Decibel Diagnosis. Pollitt, W. E. (Community Medicine, 126(27) 31 Dec. 1971). A local newspaper reported on a complaint of noise from vehicular traffic which passed a local hospital. As a result of this, noise levels in three wards of the hospital, which were likely to experience the greatest nuisance, were measured. Measurements were taken over a 24-hour period and the readings in DBA ranged from 38 DBA to 80 DBA on the ground floor, 38 DBA to 81 on the first floor and 40 DBA to 80 DBA on the second floor. The noise climate for the ground floor was 40 DBA to 70 DBA, for the first floor 38 DBA to 75 DBA and for the second floor 38 DBA to 70 DBA. The noise climate being accepted as 80% of the observed time, readings are given showing the highest and lowest reading for each of the 24 hours measured, and the noise climate for each hour is measured.

1267 Instrumental Method Substitutes for Visual Estimation of Equivalent Opacity. McKee, H. C. (J. of Air Poll. Assoc. 21(8) Aug. 1971). Many air pollution control regulations limit the emission of visible effluents, based on the visual observation of "equivalent opacity". Because of difficulties encountered in using visual observation, the Texas Air Control Board developed a method of calibration which made it possible to use an instrumental method for measuring visible emissions. A legal regulation based on this instrumental method has been in effect for almost two years. Despite minor difficulties in calibration and maintenance, results have been satisfactory. The use of the instrumental method avoids many of the difficulties inherent in using a regulation based on visual observation, and continued use of the instrumental method is anticipated.

1268 Papers Read Before the Conference on Inorganic Lead, Amsterdam, Nov. 1968. (Arch. Environ. Health, 23(4) Oct. 1971). A conference authorised by the Permanent Commission and International Association on Occupational Health met in Amsterdam in November, 1968, as one of a series of similar meetings of special groups under this same sponsorship, to engage in the presentation of prepared papers, and in discussion of standards for the maintenance of satisfactory environmental conditions, and for the medical and hygienic supervision of workmen for the preservation of their safety, health and well-being while employed in establishments engaged in the production and use of lead and its inorganic compounds. There being no official publication issued by this international professional organisation, in which the proceedings of such a conference could be given extensive presentation, an attempt has been made to provide an account of the programme and purposes of the conference and to publish such of the previously unpublished papers there presented, as would best represent the data and the conclusions of their authors.

SMOKE CONTROL AREAS

Progress Report

Position at 31 December 1971

(Figures supplied by the Department of the Environment)

	England			*Wales*			*Scotland*	*Northern Ireland*		
Smoke Control Orders Confirmed prior to 1.7.71 .. / *Acres* .. .. / *Premises*	3,520	1,006,691	4,950,223	8	1,097	4,979	ALL	37	9,400	19,611
Smoke Control orders Confirmed (1.10.71–31.12.71) / *Acres* .. .. / *Premises*	60	18,159	73,084	—	—	—	RETURNS NOT	—	—	—
Totals	**3,580**	**1,024,850**	**5,023,307**	**8**	**1,097**	**4,979**		**37**	**9,400**	**19,611**
Smoke Control Orders Submitted (1.10.71–31.12.71) / *Acres* .. .. / *Premises*	87	36,871	161,497	—	—	—	RECEIVED	1	325	408
Grand Totals	**3,667**	**1,061,721**	**5,184,804**	**8**	**1,097**	**4,979**		**38**	**9,725**	**20,019**
Smokeless Zones (Local Acts) in operation .. .. / *Acres* .. .. / *Premises*	44	34,00	41,060	—	—	—		—	—	—

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 31 December 1971

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	45,690	36·4	180,770	32·6
Yorkshire & Humberside	205,304	54·5	688,792	59·0
East Midlands	73,703	27·5	223,535	43·6
Greater London	260,582	79·7	2,266,946	85·8
North Western	211,265	52·6	881,659	51·8
West Midlands	92,512	37·1	425,162	40·5
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	896,561	50·6	4,695,561	60·4
Outside black areas ..	165,160		489,243	
Grand Totals	**1,061,721**		**5,184,804**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Winter 1971)** *which gave the position up to* **30 September 1971.** *The now show changes and additions up to* **31 December, 1971.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Tyneside and Wearside

Sunderland C.B. (Nos. 7 and 8). Newburn U.D. (No. 11). Newcastle upon Tyne (No. 13). South Shields C.B. (Nos. 5 and 6). Blaydon U.D. (No. 3). Boldon U.D. (No. 17). Hebburn U.D. (No. 12).

Teesside

Teesside C.B. (No. 6). Hartlepool C.B. (Nos. 18 and 19).

Yorkshire

West Riding (North)

Leeds C.B. (Nos. 81-84 and 86, 87). Elland U.D. Eastward 1969 and Northward 1969. Sowerby Bridge U.D. (No. 9). Spenborough B. (No. 11). Horbury U.D. (No. 8).

West Riding (South)

Doncaster C.B. (No. 12). Sheffield C.B. (Nos. 18 and 25). Darton U.D. (No. 14). Dearne U.D. (No. 6). York C.B. (No. 2).

North Western

South Lancashire and North-East Cheshire

Heywood B. (No. 10). Prestwich B. (No. 10). Sale B. (No. 11). Radcliffe B. (No. 6). Stretford B. (No. 14). Blackrod U.D. (No. 2). Horwich U.D. (No. 2). Kearsley U.D. (No. 4). Royton U.D. (No. 7). Tottington U.D. (No. 3). Urmston U.D. (No. 10). Little Lever UD. (No. 1). Worsley U.D. (No. 8). Audenshaw U.D. (No. 5). Ashton under Lyne B. (Nos. 11 and 13). Tyldesley U.D. (No. 3).

Central Lancashire

Great Harwood U.D. (No. 12). Colne B. (No. 8). Blackburn C.B. (No. 10). Padiham U.D. (Nos. 10 and 11). Church U.D. (No. 6). Darwen B. (Nos. 6, 7 and 8). Rawtenstall B (No. 2). Preston C.B. (No. 23).

Merseyside

Huyton with Roby U.D. (No. 7). Ellesmere Port B (No. 10). Bootle and Litherland (No. 1). Birkenhead C.B. (No. 7). Warrington C.B. (No. 14). Bebington B. (No. 16).

Midlands

Derby, Nottingham and Chesterfield

Alfreton U.D. (Nos. 5 and 6). Carlton U.D. (Nos. 6 and 8). Derby C.B. (No. 19). Sutton-in-Ashfield U.D. (No. 1/69). Beeston and Stapleford U.D. (No. 11).

North Midlands

Leicester C.B. (No. 27).

West Midlands

Wolverhampton C.B. (Nos. 13 and 14). Sutton Coldfield (Nos. 14 and 18). West Bromwich C.B. (Nos. 18 and 19).

South West

Bristol

Bristol C.B. (No. 10).

London

Greater London Boroughs

Waltham Forest L.B. (No. 16). Greenwich L.B. (Thamesmead). Bromley L.B. (Nos. 10 and 11). Hounslow L.B., (Brentford and Chiswick No. 11; Heston and Isleworth Nos. 15, 17-21). Southwark L.B. (No. 26). Sutton L.B. (Nos. 21 and 22). Ealing L.B. (Nos. 51 and 54). Lambeth L.B. (No. 24). Merton L.B. (No. 17). Barnet L.B. (No. 12). Croydon L.B. (No. 12). Harrow L.B. (No. 23). Bexley L.B. (No. 11). Kingston-upon-Thames L.B. (Nos. 18 and 19). Ealing L.B. (Nos. 49 and 50).

Outer London

Dartford B. (No. 10).

Local Authorities Outside the Black Areas

Tamworth B. (Nos. 4 and 5). Leamington Spa B. (No. 9). Reading C.B. (No. 14). Belper R.D. (No. 3). Blaby R.D. (No. 6). Skelmersdale and Holland U.D. (Nos. 6 and 7). Hazel Grove and Bramhall U.D. (No. 6). Todmorden B. (No. 9). Cheshunt U.D. (No. 6). Darlington R.D. (Newton Aycliffe No. 8 and School Aycliffe No. 9). Crawley U.D. (Three Bridges) Potters Bar U.D. (No. 4). Meriden R.D. (No. 5).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Tyneside and Wearside

Whickham U.D. (No. 10). Hebburn U.D. (No. 13). South Shields C.B. (No. 8). Jarrow B. (No. 6). Tynemouth C.B. (No. 12).

Teesside

Darlington C.B. (No. 7). Teesside C.B. (No. 8) and '2B' Elm tree farm, Stockton.

Yorkshire
West Riding (North)
Baildon U.D. (No. 12). Keighley B. (No. 8). Leeds C.B. (No. 95). Halifax C.B. (Nos. 17b and 18b). Stocksbridge U.D. (No. 1).
West Riding (South)
Darton U.D. (No. 18). Doncaster C.B. (No. 13). Swinton U.D. (No. 14).

North Western
South Lancashire and North-East Cheshire
Irlam U.D. (No. 5). Altrincham B. (No. 10). Hyde B. (No. 8). Swinton and Pendlebury B. (No. 7). Urmston U.D. (No. 11). Worsley U.D. (No. 10). Salford C.B. (Nos. 20 and 23). Stockport C.B. (Shaw Heath/Cale Green—North and South).
Central Lancashire
Colne B. (No. 9). Nelson B. (No 7).
Merseyside
Huyton with Roby U.D. (No. 8). Runcorn U.D. (No. 7). Wallasey C.B. (No. 16).

Midlands
Derby, Nottingham and Chesterfield
Ilkeston B. (Nos. 6 and 7). Nottingham City (No. 6a).
North Midlands
Leicester C.B. (Nos. 28 and 29).
West Midlands
Stourbridge B. (Nos. 29 and 30). Sutton Coldfield B. (No. 20). Aldridge-Brownhills U.D. (Nos. 30 and 31). Halesowen B. (No. 33).

London
Greater London Boroughs
Merton L.B. (No. 19). Sutton L.B. (No. 23). Brent L.B. (No. 7).

Local Authorities Outside the Black Areas
Burton upon Trent C.B. (No. 2). Glossop B. (No. 5). Hazel Grove and Bramhall U.D. (No. 7). High Wycombe B. (No. 7). Lincoln C.B. (No. 4). Tamworth B. (No. 6). Whiston R.D. (Halewood No. 1). Southampton C.B. (No. 12). Warington R.D. (Nos. 5 and 6). Whitley Bay B. (Nos. 7 and 8). Wortley R.D. (Chapeltown Burncross and Chapeltown Hunshelf).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern
Tyneside and Wearside
Boldon U.D. (No. 19).
Teesside
Hartlepool C.B. (No. 22).
Yorkshire
West Riding (North)
Brighouse B. (No. 29). Stanley U.D. (No. 5). Bingley U.D. (No. 17). Leeds C.B. (Nos. 96, 97 and 98). Elland U.D. (No. 3).
West Riding (South)
Conisborough U.D. (Nos. 2 and 3).
North Western
South Lancashire and North-East Cheshire
Wigan C.B. (No. 8). Bolton C.B. (Bradford and Derby Wards and Rumworth No. 2, 1971). Stretford B. (No. 15). Horwich U.D. (No. 4). Ashton-under-Lyme B. (No. 12). Worsley U.D. (Nos. 11 and 12). Westhoughton U.D. (No. 7). Manchester C.B. (Stockport Rd.; Oxford Rd., Irk Valley; Livesey Street; Butler Street and New Cross). Failsworth U.D. (No. 10). Kearsley U.D. (No. 5).
Central Lancashire
Preston C.B. (No. 24). Darwen B. (No. 9).
Merseyside
Ellesmere Port B. (No. 11). Birkenhead C.B. (No. 9). (Thingwall).
Midlands
Derby, Nottingham and Chesterfield
Buxton B. Fairfield (No. 1). Chesterfield R.D. (No. 13). Sutton in Ashfield U.D. (No. 1/1971). Beeston and Stapleford U.D. (No. 13). West Bridgford U.D. (No. 1).
North Midlands
Leicester C.B. (No. 30).
West Midlands
Aldridge-Brownhills U.D. (No. 34). Sutton Coldfield B. (Nos. 22 and 23). Halesowen B. (Nos. 34 and 35). Dudley C.B. (No. 59). Birmingham C.B. (No. 160).
Potteries
Newcastle-under-Lyme B. (No. 9). Stoke-on-Trent C.B. (No. 25).
London
Greater London Boroughs
Barnet L.B. (No. 13). Merton L.B. (Nos. 20, 21 and 22). Harrow L.B. (No. 25). Kingston upon Thames L.B. (Nos. 20 and 21). Lambeth L.B. (No. 26). Newham L.B. (No. 8). Hillingdon L.B. (Nos. 14 and 7). Wandsworth L.B. (No. 5). Sutton L.B. (No. 25). Southwark L.B. (Nos. 27 and 28). Enfield L.B. (No. 18). Bexley L.B. (No. 12).
Local Authorities Outside the Black Areas
Ramsbottom U.D. (No. 4). Workington B. (No. 1). Skipton U.D. (No. 8). Meriden R.D. (No. 6). Exeter C.B. (Barton 1971). Easington R.D. (Peterlee No. 2). Seisdon R.D. (No. 2). Luton C.B. (No. 9). Swadlincote U.D. (No. 3). Canterbury C.B. (No. 1). Todmordon B. (No. 10). Whiston R.D. (No. 4 and No. 2, Rainhill and Knowsley). Blaby R.D. (No. 7). Slough B.C. (No. 14). Bletchley (No. 1). Reading C.B. (Nos. 17 and 18). Crawley U.D. (Pound Hill) Norwich C.B. (Nos. 2 and 3). High Wycombe B. (No. 18).

NORTHERN IRELAND NEW SMOKE CONTROL ORDERS IN OPERATION

Ballymena B.C. (No. 1). Newtonabbey U.D.C. (No. 4). Lurgan B.C. (No. 3).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Belfast C.B.C. (No. 8).

AIRBORNE PARTICLES

The Spanish Government today ordered emergency measures to be taken to protect one of the world's greatest art treasures, the collections of the Prado Museum, against damage from air pollution.

A decree by the Ministry of Education and Science said that a committee of experts had been appointed to work out urgent measures within three months.

The move came after art lovers had warned for years that Madrid's increasing air pollution was harming the Prado collections, which have been valued at £400m, though no price can be put on them.
Yorkshire Post. 8.1.1972.

Air pollution shortened a man's life by three to five years, a French doctor has stated. Dr. Henri Pequignot, professor of the Medical University in Paris, said yesterday that "the average for a human life could be lengthened by three to five years if the actual pollution level in highly industrialised zones were cut down only by 50 percent".
Natal Daily News. 26.10.1971.

Burning of polythene dustbin liners in Barrow rural council's incinerator at Sileby may be polluting the atmosphere. The claim by Councillor D. E. Boulter that the fumes could be harmful is to be investigated by the authority.
Loughborough Monitor. 7.1.1972.

INDUSTRIAL NEWS

Air Sampler Unit

The latest air sampler unit from the Thermal Control Co. Ltd., of Hove, Sussex, meets the portability, accuracy, speed and ease of use requirements necessary for the study and assessment of particles in those areas where aerosol sampling is desired. Subsequent site evaluation with this new equipment is effected by the use of a similarly portable field microscope and master slide check method. (Slide mounted membranes to a set value of contamination).

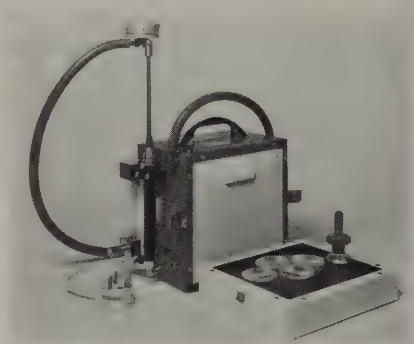
Generally, most air sampling applications can be covered by this method, but occasionally it is necessary to remove the sample to an area equipped for particle sizing, counting and physical aspect checks. Therefore, it is essential to provide some means of transferring the membrane and its collected particulate in such a way that the particles remain locked to the membrane during transit to the laboratory. To satisfy both aspects of control, the air sampling pack carries a canister of membranes suitable for point of sample use and a set of transit capsules designed to carry one membrane which is used then returned to its capsule and fluid stabilised. The membrane cannot then come into contact with extra particulate and can be carried or mailed in complete confidence.

Also new is the portability feature of this kit, which means that it can be carried complete in one case comprising motor pump unit, flowmeter, membrane holder, telescopic column, flexible tube, transit capsules, membranes, stabilising oil and tweezers.

The motor and pump unit was chosen after discussion with a leading research organisation into the reliability of induction motor driven diaphragm pumps from both the cleanness and continuous (up to eight hours) running aspects. The same thoroughness was applied to the flow metering so providing outputs up to 26 litres per minute with flow-rating accuracies much better than orifice plate control.

Orifice plate control is accurate (dependent on design and finish) by itself, but not flexible or capable of indicating changes in flow created by the membrane conditions.

The membrane holder (aerosol sampling head) is rotatable through 180° and generally uses white 47 mm gridded membranes rate at 0·8 of a micrometre (old term micron). The grids are used as focussing and manoeuvring data in field and laboratory application.



The telescopic column ensures quick and easy setting of the membrane holder and covers the height settings normally required. For example, in an assembly area with waist-level benches, the most useful sampling height would be at bench top level.

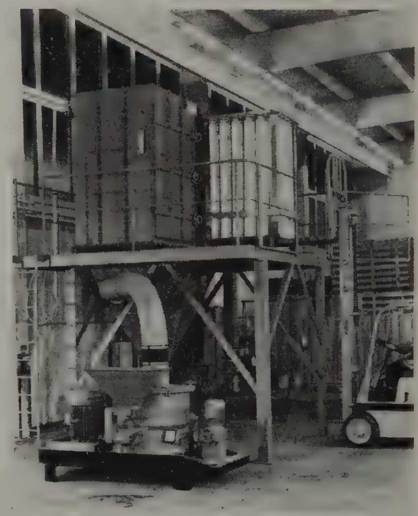
The transit capsules and stabilising oil have already been described and the tweezers are fairly obvious as a tool for moving a membrane from its container to the holder and back.

The total unit weighs 16 lb. (7·25 Kg.), is driven by mains electricity (variable a.c. and d.c. units available) and easily transported by one operator to the sampling area. Areas currently being checked are concerned with the air we breathe, pharmaceutical, chemical, specialised engineering, electronics, computer and space research fields. Some of these fields use purpose-built clean rooms to overcome the problem of contamination and it is in these regions that the Thermal Control air sampler can assess the type and number of particles per cubic foot or litre of the incoming or specific position air, and so provide the type of check necessary for proof testing.

Reader Enquiry Service No. **7216**

Side Removal Bag Filter Helps Eliminate Cross-Contamination

The use of dust collectors in situations where product purity is essential and product change is necessary, is made easier by the use of a side removal Mikro-Pulsaire, a new design from Mikropul Ltd.



In this new design the housing is equipped with an access door through which the entire bag plate can be removed, and replaced, by a bag plate fitted with clean bags, allowing for product change with a minimum of down time. After cleaning a new bag plate, complete with filter bags, can be inserted through the large access door. The plate is secured by two quick release catches and is then ready for use on the next product. In

the dyestuffs, pure chemicals and pharmaceuticals industry, where cross-contamination cannot be tolerated, the advantages of the side removal technique are obvious.

Reader Enquiry Service No. **7219**

Vokes Build U.K.'s Largest Filtration Laboratory

A new research and development centre costing over £¼ million is under construction at the Henley Park headquarters of Vokes Ltd. When it is completed this summer it is expected to rate as the largest privately owned specialist filtration laboratory complex in the U.K.—and probably in the world.

Included within its 25,000 sq.ft. of floor space will be six different laboratories all biased towards the solution of industrial air and liquid filtration problems. Also housed in the complex will be a new development workshop, development design and drawing offices, a research library and administration offices.

The new centre will allow Vokes the extra space required to expand its activities in the filtration research field and give room to house more sophisticated equipment.

This will enable Vokes to offer extended facilities for the investigation of customer's filtration requirements and also supply the most reliable scientific backing to the filters marketed by the company throughout the world.

Reader Enquiry Service No. **7220**

Electric Living Trade Fair

The Electric Living Trade Fair was held at Harrogate in the Exhibition Centre from 1-3 February. It was truly an electric-living fair and had everything on exhibit from central heating systems to gimmicks such as electric toothbrushes. There were 133 exhibitors at the exhibition which ran jointly with the annual conference of Electricity Boards.

This year the emphasis was on new cookers. There was little new in the way of heating systems but many new designs in fireplace heaters complete with modern surroundings were displayed. Also on display were new portable fan heaters and new convectors for halls, dining rooms and studies. One new idea was a circular fluorescent tube combined with a small but powerful radiant heater for use in place of a ceiling light in kitchens, halls and bathrooms.

There were also new storage heaters on display. Electricaire ducted warm air central heating and Centralec small bore heating units were also shown with new versions.

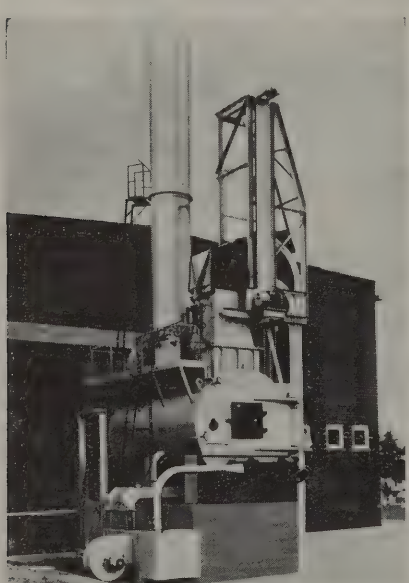
Reader Enquiry Service No. **7218**

New Incinerator Burns Asbestos Brake Linings Without Smoke

A new industrial incinerator installed for BBA Group of Companies has been proved successful over the last 18 months in burning reject clutch and brake linings and conveyor belts—products made from resin-bonded asbestos. The new incinerator—an SF5 model by Universal Machinery Ltd of Leeds—copes with approximately twice the amount of material as its predecessor with still only one attendant.

Vast increases in production of asbestos products has obviously increased the number of new items rejected during inspection. The obvious dangers of pilferage from tips of new but rejected brake linings for example made incineration the only practical method of disposal, while legal restrictions on the transport of asbestos made a combination of burning and tipping ideal. At the site—where the new incinerator blends with its environment—a 10 year reclamation programme is in hand and already some 2½ acres of otherwise unusable land has been reclaimed for farming. Burning of brake linings has previously caused volumes of dense smoke from the resin bonding agents but the new incinerator is relatively smokeless.

The incinerator also copes on occasion with confidential documents—solidly-packed paper which is always difficult to burn. The unit is oil-fired with electrical starting but burning brake linings once 900°F is reached—usually after about 45 minutes—the



oil supply is switched off for the rest of the day. Loading is automatic after the hoist bucket has been manually loaded from container vehicles while ash is sprayed with water before falling into a 2-ton damper fitted with a scraper-blade for site levelling, the dumper driver coping alone with the entire site operation.

Water used to damp-down the sludge drains through a settling tank into a stream clean—to the satisfaction of the local authority. The new model incinerator was factory tested before installation on site with daily training visits for two weeks by a Universal engineer.

The unit has now been working over a year—usually at full capacity of ½ ton per hour 8 hours every day per 5 day week; when working continuously it could burn asbestos products at the rate of 80 tons per week with even more economical use of fuel oil. Mr Richard Guiver of Universal claims that "Apart from the considerable environmental advantages of smokeless incineration, even when handling such difficult materials as asbestos, the BBA installation is obviously proving most economical to this important public company".

A complete range of these smokeless incinerators is now available from Universal Machinery Services Ltd.

Reader Enquiry Service No. **7217**

New Filter Loss Gauge

Airflow Developments Ltd., have produced a new filter loss gauge (FL 1·5) which has been designed specifically for monitoring the build-up of dirt within the filters in air conditioning and industrial ventilation systems.

The gauge is comprised of an inclined manometer limb, giving good magnification, and is mounted in a one-piece light alloy body. The range of the new filter loss gauge has been increased to 1·5 in. w.g. to accommodate the higher pressures now being used in air filtering systems.

The gauge fluid is blended paraffin dyed a deep orange/red to give an extremely clear and free moving meniscus. Apart from having a very clear scale marked in 0·02 in. w.g. graduations, two self-adhesive flags are provided, one 'Filter Clean' and one 'Filter Dirty' which can be fitted against the manometer limb. These immediately pin-point the state of the filter indicating whether action is required or not, thus contributing to the efficiency of the system being filtered. In industrial ventilating systems, this also has a bearing on the industrial health of the employees.

Each gauge comes complete with 6 ft. of PVC tubing, two duct connectors for attaching tubing to the duct each side of the filter, spare fluid and funnel, fixing screws and instructions. The FL 1·5 is fitted with a built-in spirit level.

Reader Enquiry Service No. **7221**

Removing The Smell From Processing Poultry Manure

Removing smells created by processing poultry manure has saved the world's largest operator in this field from closure—and made life for surrounding residents a great deal happier! The solution was an "after-burner" installation by British Gas and Oil Burners Ltd.

The system has proved 100% effective and is at present being converted to natural gas. A result of the original work is that the operator is, with the help of BGOB Engineers, providing a consultancy and equipment provision service to companies with process odour problems in the manure drying and in the offal, and fat and bone rendering trades.

Successful operation of Weldon Agricultural Products, in Norfolk, is a personal triumph for Derek Weldon, the owner of the world's largest poultry manure processing plant. A former executive in the agricultural feed industry, he bought the plant when Ross Foods decided to close it down because of local pressures culminating in a High Court injunction.

With British Gas and Oil Burners of Thetford, a system of six oil-fired burners firing into the process exhaust gases was devised and completed on the last day before the injunction took effect. Even so, a writ for contempt of court was served on Mr. Weldon before he could prove that the smell had been eliminated!

Mr. Weldon commented· "The company had a list of hundreds of people over a 10 mile radius who had complained of smell. The High Court judge gave us a month to test reaction. I'm glad to say not one person had cause for complaint, and there have been no objections since."

About 300 tons a week of poultry manure is processed at the plant. Main feature is a flash drier, in which the manure is dried quickly at high temperature, speed being essential to prevent destruction of protein content. A heavy oil burner, also being converted to natural gas, is used to fire the drier.

Exhaust gases are led to a 75 foot chimney. The answer to the odour problem was to install an after-burner system prior to the chimney. This consists of six IBF burners, in combustion chambers, which heat the exhaust gases to 600°C and destroy the odorous particles.

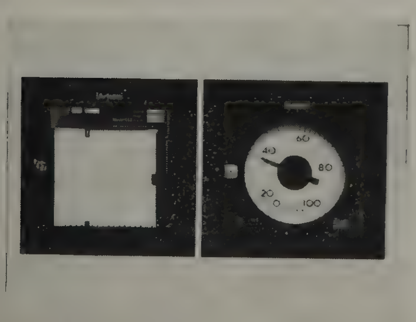
The basic system comprises of six IBF/FD 60 Oil Burners, firing Class D fuel oil collectively at a rate of 50 G.P.H. The burners are positioned tot fire tangentially across the waste gas stream, heating the waste gases from 150°C to 600°C. At this temperature all the obnoxious fumes in the gases are burnt off, and the dark smoke that used to be produced is transformed into a respectable white plume.

Reader Enquiry Service No. **7222**

New, Mercury-Free, High Pressure Flow Instruments From Arkon

A new, mercury-free, flow recording instrument, suitable for steam, high pressure gas, air, water or other liquids, has been introduced by Arkon Instruments Ltd. The new product is said to provide the advantages of the established Arkon type of large scale, six-week capacity linear strip chart instrument, at less cost than customary circular-chart recorders.

Designated the Arkon model 63-2 the same basic instrument can also be supplied as a straight indicator—i.e dial instead of chart recording mechanism.



The Arkon 63-2 represents a very significant technological and cost breakthrough in the field of high-pressure flow measurement and recording. Not only does it make possible the measurement of flows at static pressures up to 500 psi (3·5 MN/m^2), but the design enables it to be used on steam, water and other non-corrosive fluids, without any of the problems and cost-factors associated with ordinary mercury-filled high-pressure recorders. Added to these advantages is that recording is carried out on a 6 in. (150 mm) high rectangular roll chart, which has a linear scale over 75 per cent of the flow range and lasts up to 6 weeks; the chart can be left on the re-wind roller or cut off as required—the free end automatically being picked up again. Readings are therefore easily read and interpreted without the difficulties of limited scale length and the 'logarithmic' compression of scale associated with circular charts. The recorder version of the Arkon 63-2 is priced at £195; the indicator version at £168.

Additional facilities include an electrically operated integrator which enables the instrument also to function as a meter, and alarm contacts and potentiometers for use in conjunction with control circuits. Recorders can also be provided with chart illumination, a vertical indicatotr scale and pointer and, when necessary for hazardous location, flameproof chart and integrator drive motors.

The Arkon 63-2 can also be used in conjunction with other Arkon accessories such as the Multiple Switching Unit and a Signal Converter for control or remote indication purposes.

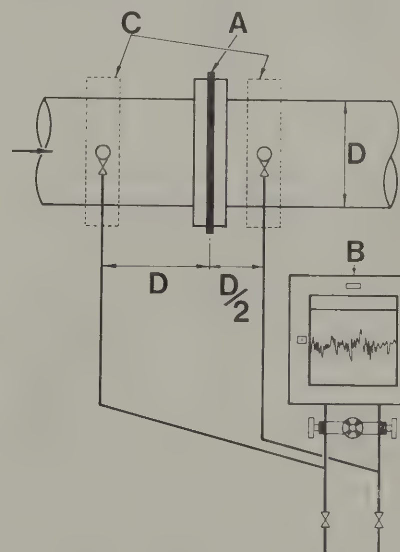
A duplex version of the instrument can also be supplied when it is required to record both flow and static pressure. A second pressure sensing element is then fitted to record static pressure and charts with dual flow and pressure graduations are used, in conjunction with two pens marking in blue and red ink.

Arkon have for fifty years specialised in instruments for the recording and/or indicating of flow, but hitherto only at pressures up to 30 psi (0·20 MN/m^2). Many fundamental features of the new high-pressure instruments—the basic chart mechanism for instance—have therefore already been well established and proven by Arkon over this period with the existing Arkon range of low pressure instruments.

The main development in the model 63-2 is the pressure sensing element and associated mechanism. This comprises a large diameter slack diaphragm, the movement of which is controlled by a calibrated spring. This simple and robust unit provides a substantial operating force while ensuring that components essential to accuracy and consistent calibration are isolated from the service being measured.

In application, the instrument is used in conjunction with a differential pressure device—usually an orifice plate installed in the fluid stream.

The impulse pipes from either side of the differential pressure device are connected to the top and to the underside of the slack diaphragm. Variations in flow create a change in differential pressure which causes the diaphragm to move until equilibrium is restored by a change in spring tension.



A—Orifice plate

B—Arkon 63-2 recorder

C—Condensation chambers (for steam only)

D—Pipe diameter

The mechanism has low inertia and friction, and is sensitive to small changes in flow rate. An oil filled dashpot is incorporated to damp-out excessive oscillation.

Because rate of flow is proportional to the square root of the differential pressure ,the relative displacement of the diaphragm is not, itself, linear. The diaphragm movement is therefore transmitted to the pen or pointer through a cam and ligament

mechanism. This translates the movement into a linear one which can be clearly presented on a uniformly divided chart or dial. This is particularly valuable when a clear reading is required at the lower end of an instrument's range as the scale is linear down to 25 per cent of the flow range.

For steam or liquid flow measurement a 3-cock assembly is fitted to isolate the instrument from the high and low pressure impulse lines and equalise the pressure across the measuring element for zero checking.

For gas or air flow, a dual valve assembly is fitted which is operated by a single knob. This ensures simultaneous shutting off and equalising.

All model 63-2 instruments are fitted as standard with two air vent screws. For steam flow measurements a pair of carbon steel condensation chambers is a necessary extra which Arkon can supply.

Reader Enquiry Service No. **7223**

Air Products to Build Britain's Biggest Natural Gas Liquefaction Plant for the Gas Council

Britain's biggest plant for the liquefaction of natural gas is to be designed, manufactured and built by Air Products on Canvey Island under a £945,000 contract signed with the Gas Council. Due to come on-stream in the late summer of 1972, the plant will have twice the handling capacity of the Gas Council's only other LNG plant at Glenmavis, Scotland.

Already piling work has been completed at the Canvey Island site—three weeks ahead of schedule—in preparation for the laying of foundations and installation of process equipment. Major components for the plant such as the re-liquefier unit with its explosively bonded coil wound heat exchanger are currently being fabricated at Air Products' Acrefair works in North Wales, and will be installed on site early in the new year.

The Gas Council decided to build a liquefaction plant at Canvey Island to provide standby capacity and to enable 'boil off' to be handled from the frozen ground tanks at the site.

The Methane Terminal at Canvey Island has been Britain's main centre for the storage of natural gas since it was built in 1964. Today the Terminal handles about 700,000 tons of liquid gas each year and has storage tanks available for over 110,000 tons of liquid product.

At present, all the Gas Council's imported LNG comes from Algeria and is largely for immediate delivery to the natural gas grid as a base load.

Air Products' plant will provide standby capacity by liquefying natural gas from the new North Sea wells in addition to liquefying boil-off gas from the existing storage tanks for return to storage, thus enabling the volume of LNG in storage to be maintained. The plant will be capable of operating 24 hours per day and sophisticated instrumentation and automation have been specially developed by Air Products for the control of the plant.

Reader Enquiry Service No. **7224**

National Carbonising Invest £500,000 in New Coking Ovens

A £500,000 investment in the future of hard coke for the industrial and domestic markets has been anounced by N.C.C. (Coke) Ltd., one of the National Carbonising Company's subsidiaries.

Work has already begun on the rebuilding of No. 2 Battery of coking ovens at their Barnsley District Coking works and completion is scheduled within twelve months.

The present No. 2 Battery is now over 23 years old and is being replaced by 17 Woodall Duckham underjet ovens which incorporate the latest equipment and modifications to give maximum efficiency. Double collection mains have been included in the rebuilding programme to minimise local air pollution.

While the Woodall Duckham Construction Company is working on No. 2 Battery the remaining 45 ovens at the works will continue in production.

This investment in coke is announced when another part of the group, N.C.C. (Rexco) Ltd. is commissioning its new £1·9 million smokeless fuel plant at Snibston colliery at Coalville, Leicestershire. This plant will provide an additional 250,000 tons to take annual production of Rexco multi-purpose fuel up to over 1,000,000 tons.

Hayes Shell-Cast (Developments) Ltd.

Hayes Shell-Cast Ltd., The Hayes, Lye, Stourbridge, Worcs, manufacturers of High Duty Grey and Nodular Iron Castings, announce the formation of a subsidiary company Hayes Shell-Cast (Developments) Ltd., the registered office of which is at the above address.

The new company has been formed to market a process of gas fired melting, which completely eliminates the use of coke, and from which there is no visible emission. The process, developed by Hayes Shell-Cast Ltd., on a pilot-scale over a period of two years or more, is now operating on a regular production basis. One of their 4 ton per hour cold blast cupolas was converted to gas firing at the end of 1970 and is being used by them for normal production alternating daily with a standard coke fired cupola.

Patent rights for the new process have been applied for.

Reader Enquiry Service No. **7225**

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SUMMER 1972

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Vol. 1 No. 6 Summer 1972

Principal Contents

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CLEAN AIR

United Nations Conference on the Human Environment, Stockholm 5-16 June, 1972

Mr. Maurice Strong, Secretary-General of the United Nations Conference on the Human Environment, recently issued a statement regarding the progress made with preparations and announced the Action Plan proposed for the Stockholm Conference.

In essence, the Action Plan is made up of the recommendations for international action and a framework into which such actions fit. This framework presents a new global approach to complex environmental issues, and has been designed to aid the international community in the difficult tasks of better environmental management and control. It states explicitly the steps that must be taken by the peoples and governments of the world to identify environmental problems and to proceed systematically towards their solution.

A key element of the Action Plan is a global environmental assessment programme called "Earthwatch". This will be an internationally co-ordinated programme based on the linking of established international and national programmes and activities involving governments, international agencies and non-governmental sources all working together in a co-operative approach to the identification and assessment of environmental problems of global importance.

The recommendations that make up the overall Action Plan are contained in reports dealing with the subjects to be discussed at the Conference. One such report entitled "International Organization Implications of Action Proposals" has raised the question of what kind of new organization mechanism and financial means are needed at international level to carry out the actions agreed to by governments at Stockholm. So far, organizational proposals focus on the need for an intergovernmental body to provide the necessary policy guidance, and a central focal point within the United Nations Secretariat to provide leadership and co-ordination. For finance, governments are being asked to consider the desirability of setting up an "Environmental Fund" to pay for activities which can be best carried out collectively. It has been pointed out that such a fund must be justified on environmental grounds and financed primarily by the industrial countries.

Governments have been asked to outline their environmental experience in national reports and to provide supplementary basic papers and case studies on subjects in which they have particular interest or experience. The specialized agencies and other United Nations bodies have also submitted basic papers drawing on their knowledge and experience in their various areas of responsibility. A total of 115 governments have so far participated in the preparatory process and some 350 basic documents totalling 12,000 pages, have been received by the Conference secretariat. It is intended that all this material will be made accessible as a reference source.

The report containing the Action Plan gives the background for the recommendations and assesses the state of the environment today. It cites eight major premises that have merged from the preparatory process and these provide the basis for the decisions the Conference will be called upon to consider. These are:

1. Man interacts with the natural environment through a complex system of relationships embracing the entire planet. His life and well-being largely depend on a healthy equilibrium in this system of relationships.

2. Man's activities, based on the power which science and technology makes available to him, now take place on a scale which make them principal factors in the determination of his own future. They have given man not only the technological potential to bring vastly improved conditions of life to all, but also unprecedented potential for destruction.

3. Because man's future depends on the choices he makes concerning his activities, he requires better means of assessing their possible consequences.

4. On a global basis, the combination of man's increasing numbers and the intensification of his activities in placing growing pressures on resources cannot continue indefinitely without placing the future of all mankind in serious jeopardy.

5. Man needs to have a more balanced development of the world's productive capacity and significant redirection of its industrial and scientific capabilities.

6. This calls for new dimensions of co-operative behaviour on all levels.

7. Developing countries, while having the same environmental concerns as industrial countries, also face environmental problems deriving from poverty.

8. The ultimate goal must be to achieve a dynamic equilibrium between man and the natural environment.

Pointing to the cost of technological progress the report mentions in particular natural resources mined and used up; wastes and effluents produced by modernized agriculture, industry and urban concentrations poisoning the rivers, loading the land and polluting the air; global climatic changes which could result from increased emissions of heat, carbon dioxide and particles. The report adds that while few scientists believe that any of these risks have yet reached the point of irreversibility, few would deny the real possibility that this might happen.

Regarding development and the environment the report accepts development as a primary need for all states. In wealthier lands this should be through forms of activity less demanding and less polluting, and in poorer states, helped by financial aid, through those kinds of industrialisation which use non-polluting technologies and all the new concepts of rural-urban balance.

If "the environment" is to be taken to mean the whole world, then it can be seen that the United Nations must be involved because it alone possesses the means by which the necessary international response to the global challenge can be launched.

One of the recommendations of the Action Plan most emphasised concerns the balance between available and usable natural resources and the many competing demands which require wise policy and good management. It now seems clear that the planning, development and management of natural resources could be much more efficient if it is carried out in an integrated manner. But will all nations agree to this?

Turning more directly to pollution, the main areas of concern include protection of human health and well-being, direct and indirect, present and future; prevention of food contamination; preservation of air and water quality; global assessment of climatic changes; study of effects of critical pollutants on the terrestrial ecosystem, and the comprehensive approach to preserve the quality of marine life. The proposed actions to cope with these problems are divided into three categories: the proposed Earthwatch programme concerned with assessment of pollution ptoblems of international significance; management of pollution problems by international consultation and agreement on standards; and supporting activities comprising education and training, technical co-operation, organizational and financial arrangements and public relations.

No international programme for pollution control can be effective, unless it is supported by concerted action by Governments. Most sources of pollution occur within national boundaries and so governments are urged to use the best practicable means available to minimise the release to the environment of persistent and toxic substances, particularly heavy metals and organochlorine compounds unless their release is proved harmless, or if their use is essential to human health or food production, to use appropriate control measures. Governments are also encouraged to take into account the relevant international environmental standards in developing their own.

Education and training in environmental problems at all levels are essential to the success of environment policies. The hope is therefore expressed that UNESCO will implement the promotion of an international programme of technical and financial co-operation.

In considering the Action Plan the report admits that the Conference will find little precedent to guide it. Nor will it always be able to rely on conclusive information and knowledge on which to base its decisions. It will have, nevertheless, a heavy responsibility to speak to the world in the new and compelling language of mankind's essential interdependence.

The Society has contributed something to the 12,000 pages of the 350 basic documents with which the Conference secretariat have had to deal, and for over seventy years has been very actively concerned, nationally and internationally, with one of the problems it will be considering. We wish the Conference every success in its endeavours and trust that real progress towards a better world will be the outcome.

AN INDUSTRY'S NATURAL CONCERN

by

Jeffrey Preece

Central Electricity Generating Board, Midlands Region

There are few modern industrial installations which make a more dramatic visual impact upon the environment than a power station. Almost inevitably a big inland station is sited on a major river to provide the huge quantities of water needed for cooling purposes, and in the characteristic flat landscape of the river valley its chimneys and cooling towers dominate the scene for miles around.

This is a fact of contemporary life. The engineers and the architects who design these massive power factories, costing now over £100,000,000 apiece have to draw on all their skills and art to ensure that their structures demonstrate the fitness for purpose which results, if not in beauty, at least in visual acceptability.

The power station then has to be operated in a way which does no tangible harm to the environment, and to the life within it. That life ranges from the fishes of the river and birds of the air to man himself. It includes the plants and trees of the countryside as well as the farmers' crops. In all these matters the quality of life itself is at stake, and the responsibility in terms of clean air, clean rivers, noise suppression and so on which rests on the Central Electricity Generating Board and its staff is a heavy one. The Board's policy is not only to meet its statutory obligations but to go as far beyond them as its responsibilities to the public as electricity consumers, as shareholders and as taxpayers allow.

At almost any of the C.E.G.B.'s 180 power stations, big and small, some aspect of this natural concern is to be seen. Nowhere is it so evident, in so many different ways, as at Drakelow, near Burton-on-Trent. This is one of the greatest concentrations of power generation in the whole of Europe—three coal-fired power stations under a single management, with a total capacity of 2,175,000 kilowatts, which is greater than the maximum demand of the cities of Birmingham and Nottingham combined.

You will find boiler houses and turbine halls, chimneys and cooling towers, coal heaps and ash lagoons at Drakelow. But you will also find, on the 750 acres of the site, a nature trail and children's field study centre; a wildfowl reserve; crops growing and livestock grazing on

Land left derelict by ground working at Drakelow cannot be developed because it is in the floodplain of the River Trent, So the CEGB has dedicated its pools and banks as a wildfowl reserve.

once derelict land which has been restored with power station ash. You will also see woodlands containing 150,000 trees under forestry management and a tree nursery where 100,000 saplings are being raised by expert staff for transplanting as woodland screen at other power stations and switching stations all over the Midlands.

Because of this probably unparalleled range of conservation activities, Drakelow is one of the most-visited industrial sites in Britain. Conservationists, educationalists, agriculturalists and kindred experts from all over the world go there to see a living, developing, demonstration of that planned and purposeful co-existance between technology and nature on which the future of the world and of mankind depends.

All this was not achieved overnight. It began almost accidentally back in the 1950s when Drakelow was first being developed by the newly-nationalised electricity supply industry. And its beginning was very much tied up with the long, rich history of the Drakelow estate itself, which for 850 years was owned by the de Gresley family. Once there was Drakelow Hall, an Elizabethan mansion. That was demolished in the 1930s but when the site was acquired in 1948 by the British Electricity Authority—forerunner of the C.E.G.B.—the pastures and parkland of the estate remained as an area of great beauty.

Nature trail at Drakelow power station.

A deliberate policy was adopted of preserving as much as possible of this natural beauty amid the tumultuous upheaval of constructing a £150,000,000 industrial complex. Much of the original woodland was preserved, including many mature and handsome trees. This woodland was supplemented by large-scale new planting to provide screens. The programme formed part of a professional landscaping operation to soften the visual impact of the stark structures of the power station buildings and associated electrical equipment.

To maintain this landscape to the high standards it merited the C.E.G.B. set up its own staff of specialists. From the lessons learned on the Drakelow site and elsewhere the regional management of the C.E.G.B. developed this team into a well-integrated unit with responsibilities for landscape maintenance at 26 power station sites and 116 sub-stations throughout the Midlands. The unit's headquarters, its nurseries and greenhouses are still at Drakelow, and from there and other centres its mobile, well-equipped teams travel to work at the various sites for which they are responsible.

Other conservation work at Drakelow has stemmed from this work. Before "conservation" and "environment" were words on everyone'ss lips, the C.E.G.B. had identified ways in which with little cost but great benefit it could make available areas of its land for activities both to protect natural life and to enhance the understanding of the delicate inter-relationship of man and nature in an industrial society.

With guidance and enthusiastic support from naturalists and the world of education, the Board set up in the Drakelow woods the first nature trial open to schoolchildren on an operational industrial site anywhere in Europe. That was in 1967. Since then the nature trail at Drakelow and its associated field study centre has been in regular use by thousands of schoolchildren, ranging from infants to sixth-formers as an open-air classroom and field laboratory. Similar developments have followed at many power station sites, and other industries have followed suit, but Drakelow's pioneering role continues.

A more recent development has been the creation of a wildfowl sanctuary in the flooded pits of old gravel workings on the site, within a loop of the River Trent. It was Peter Scott, Director of the Wildfowl Trust, who first pointed the potential of the site, which lies on one of the major flight lines of migrating birds. Again the C.E.G.B. was able to provide an amenity of great value to wildlife and its devotees, and again at minimal cost in financial terms. Like the nature trail, it was made possible by a close working partnership with outside interests, including ornithological groups and preservation societies, who shouldered much of the job of management and administration.

All this work, and other activities such as joint experiments with universities and research stations on the use of power station ash for land reclamation and agricultural restoration, helped to win Drakelow a Countryside Award in 1970 under the scheme sponsored by Prince Philip to recognise activities which have produced physical improvements to the English countryside and have made a contribution to increasing awareness and understanding of its value.

The C.E.G.B. will always be judged first and foremost on the efficiency with which it discharges the statutory duty to provide a reliable and economic supply of electricity for the nation. Its performance in preventing pollution is also continuously weighed in the balance, and not usually found wanting. Conservation activities, such as those at Drakelow, are a bonus thrown in by those who manage and run this giant industry on the public's behalf to show that they share and support the growing hunger for an improved quality of life.

EFFECT OF SUSPENSION OF SMOKE CONTROL ORDERS ON SMOKE CONCENTRATIONS

by
Maria-Louise Weatherley,

Warren Spring Laboratory, Department of Trade and Industry

In 1970, because of a shortage of solid smokeless fuels, orders were made by the Secretary of State for the Environment, at the request of individual local authorities, temporarily suspending the operation of smoke control orders in their areas. These suspension orders came into operation on dates between May 1970, and January 1971, more than 80 per cent of them coming into force at some time in November or December 1970. Suspensions lasted either till the end of March, or, more commonly, till the end of April 1971. In some places the smoke control orders had not actually become operative so that in effect the suspensions deferred the starting date for smoke control. In a few places suspension orders had been made in the previous winter (1969-70).

To quantify the effect on pollution in the affected areas, local authorities making smoke measurements were asked whether or not their measurement sites were within suspended smoke control areas. The information supplied also specified whether or not sites were within 400 yards of the edge of a suspended smoke control area. Using this information two lists were drawn up, one of sites well within areas in which smoke control orders had been suspended after having been in force, and one of sites well away from any such areas, the latter sites being a random selection of one in five of all such sites in the United Kingdom.

A comparison for both sets of sites was then made between smoke levels in winter 1970-1 and those in the previous winter. A similar comparison was made for sulphur dioxide in the two winters; in this case there was no reason to expect a measurable effect due to smoke control order suspension.

Ground level concentrations are a function not only of emission levels but also of dispersal conditions, which are especially dependent on weather. It was hoped that by comparing the changes in smoke from one winter to the next at the sites in suspended smoke control areas with those at the other sites, and examining the corresponding changes in sulphur dioxide, effects of weather differences in the two winters could be eliminated in a rough and ready way.

Analysis of Data

The data used in the comparison are summarised in Table 1 and relate to the months of December to March inclusive for 1969-70 and 1970-71.

In December 1970 sites not affected by suspension of smoke control orders had 17 per cent less smoke than in the previous December, compared with 10 per cent less for affected sites. This suggests that the effect of suspension was to increase smoke concentrations by about 7 per cent, or some 5 $\mu g/m^3$, but the difference between the decreases at affected sites and the others was not in fact statistically significant. In January, February and March 1971, there were statistically significant differences (at the 1 per cent, 5 per cent and 1 per cent levels of probability, respectively) between smoke at sites in suspended areas and at the others, relative to the previous winter's values. The suspended areas had on average an extra 12 to 15 $\mu g/m^3$ in these months compared with the others.

Although an average increase of this amount in smoke is not very high, there was also, at the suspended area sites, greater scatter about the mean differences between the two winters in all the months examined and this greater degree of scatter was statistically significant for the months of January to March (at the 5 per cent, 5 per cent and 1 per cent probability levels respectively). In other words a higher proportion of the sites in areas where control orders had been suspended had very much higher monthly average smoke in the second winter (50 to 100 $\mu g/m^3$ more) after suspension. On the other hand many sites within suspended areas had monthly average smoke during the period January to March, 1971, up to 30 $\mu g/m^3$ lower than in the corresponding month of 1970.

Sulphur Dioxide

In contrast there was no significant difference in any month between sites in suspended smoke control areas and other sites as far as mean difference in sulphur dioxide between winter months in 1969-70 and corresponding months in 1970-1 is concerned. Nor was the scatter about the mean of the differences between the winter months at individual sites significantly different for the two types of site except in the month of February. The significant difference, at the 5 per cent level,

TABLE 1: Smoke and Sulphur Dioxide in Winters 1969-70 and 1970-1
(concentration in $\mu g/m^3$/ difference is later year—earlier year)

	December 69 70	January 70 71	February 70 71	March 70 71
SMOKE				
a) Sites in suspended smoke control areas				
No. of sites	15	28	28	27
Concentration	93 84	73 95	61 81	51 62
Difference..	− 9	+22	+20	+11
Difference, %	−10	+30	+33	+22
b) Other sites				
No. of sites	20	29	33	25
Concentration	90 75	80 90	60 67	50 46
Difference..	−15	+10	+ 7	− 4
Difference, %	−17	+12	+10	− 8
SULPHUR DIOXIDE				
a) Sites in suspended smoke control areas				
No. of sites	16	28	28	27
Concentration	194 163	183 186	158 159	143 135
Difference..	−31	+ 3	+ 1	− 8
Difference, %	−16	+ 2	+ 1	− 6
b) Other sites				
No. of sites	20	28	30	22
Concentration	180 154	162 170	147 135	134 123
Difference..	−26	+ 8	−12	−11
Difference, %	−14	+ 5	− 8	− 8

in scatter in this month had nothing to do with the suspension of smoke control but was caused by abnormally high pollution in the earlier year at one of the control sites. This particular site was not installed to give general background levels of pollution and is known to be affected by a chimney nearby.

Conclusion

There are so many possible factors which may affect pollution at any individuad site, apart from suspension of smoke control orders, that without making a detailed study of the area concerned it would be unwise to attribute an increase at any one site to this cause alone. However, valid comparisons can be made between groups of sites and these show that over the period January to March 1971 the group of sites in suspended smoke control areas had extra smoke, attributed to suspension, amounting to about 13 $\mu g/m^3$ on average for the group as a whole. Some sites in this group had more additional smoke during this period, up to 100 $\mu g/m^3$ more in a monthly average, which may or may not have been due to the suspension, whilst others showed no increase, or even a decrease of up to 30 $\mu g/m^3$ in a monthly average, compared with the corresponding month in the previous winter. The number of sites affected was in any case only a small proportion of the total. The relatively small average increase no doubt reflects the fact, supported by fuel consumption statistics and some local authority findings in connexion with smoke control orders, that there is a definite trend away from solid fuel and towards gas and electricity for domestic heating, both within and outside smoke control areas.

Acknowledgment

Warren Spring Laboratory would like to thank the local authorities who provided the necessary information. The help of Mrs B. D. Goorish and Mr M. P. Payne in making the calculations is also acknowledged.

SURVEY IN SELNEC

by A. T. Traynor

Borough of Middleton

A smaller but similar survey was carried out amongst the member Authorities of the South East Lancashire and North Cheshire Consultative Committee for the Investigation of Atmospheric Pollution and Noise. In common with Warren Spring Laboratory a wide "scatter" of differing comparative results were found. It was appreciated that there were many factors which could have affected these figures, especially over the short term, but one factor obviously was the extent to which people had changed over to coal in different Smoke Control Areas.

It was generally found that old age pensioners readily went over to coal in many areas because of the saving in cost. This initiated an approach by SELNEC to the Department of Health and Social Security for monetary asistance for old age pensioners required to burn high priced smokeless fuels, but this was rejected.

The only publicly expressed opinion on suspension what that it was a bad thing. People regretted the reappearance of smoke and soot—particularly visible on paintwork, washing and motor cars.

SOUTH EAST LANCASHIRE & NORTH CHESHIRE CONSULTATIVE COMMITTEE FOR THE INVESTIGATION OF ATMOSPHERIC POLLUTION

Comparison of Results—Before and After the Suspension of Smoke Control Orders
Mean figures—Microgrammes per cubic metre

Two Authorities where Orders made prior to 1964 only were suspended	SMOKE						SULPHUR DIOXIDE					
	1969 Oct-Dec	1970 Oct-Dec		1970 Jan-Mar	1971 Jan-Mar		1969 Oct-Dec	1970 Oct-Dec		1970 Jan-Mar	1971 Jan-Mar	
DUKINFIELD Health Department..	165	132	20% Decrease	153	141	7·9% Decrease	196	171	12·8% Decrease	279	217	22·3% Decrease
Gorse Hall Road ..	117	103	22% Decrease	109	115	5·5% Increase	151	181	19·8% Increase	264	177	33% Decrease
MIDDLETON Central Library ..	155	176	13·5% Increase	170	272	60% Increase	294	266	9·6% Decrease	297	288	3·1% Decrease
Six Authorities where ALL Orders were suspended												
DENTON Health Department..	188	80	57·5% Decrease	90	102	13·3% Increase	213	186	12·7% Decrease	236	233	1·3% Decrease
Water P.C. Department	96	83	13·6% Decrease	77	120	44·2% Increase	120	107	10·9% Decrease	142	148	4·2% Increase
FAILSWORTH Health Department..	187	166	11·2% Decrease	175	158	9·7% Decrease	197	192	2·6% Decrease	238	225	5·5% Decrease
FARNWORTH Town Hall	188	142	24·5% Decrease	195	161	17·5% Decrease	219	204	6·9% Decrease	219	231	5·5% Increase
Wilfred Greere House	91	79	13·2% Decrease	83	95	14·5% Increase	133	117	12% Decrease	141	150	6·3% Increase
HYDE Health Department..	181	183	1·1% Increase	148	159	7·4% Increase	139	140	0·7% Increase	150	181	20·6% Increase
RADCLIFFE Health Department..	—	—	—	179	148	17·3% Decrease	—	—	—	236	221	6·4% Decrease
ROYTON Sewage Works ..	—	—	—	63	44	30·2% Decrease	—	—	—	110	90	18·2% Decrease

Public Health Department
Town Hall,
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A. T. TRAYNOR
Honorary Technical Officer
10th June, 1971.

ELECTRIC VEHICLES IN MUNICIPAL SERVICE

by

J. M. Warrington

Harbilt Electric Trucks and Vehicles

Paper presented at the Electric Vehicle Work Study Days. Organised by the International Union of Producers & Distributors of Electrical Energy, 13-14 March, 1972. Brussels.

Introduction

Recent international reports stress the serious consequences of air pollution and noise in cities, towns and urban areas of the world and much is directed towards persuading everybody concerned to do all in their power to protect the environment by preventing air pollution and ensuring that everybody can be free from filth, fumes and noise. In the immediate future, World Governments will obviously be very much concerned with this problem and it would appear logical that local authorities will be called upon to take a lead in this exercise.

Transport plays a very important role in a provision of services to the community by local authorities and as these services are usually confined to the particular urban area concerned, the distance of travel involved each working day is not very great and the vehicles concerned are usually involved in multi-stop-start operations. Whilst many local authorities are using petrol and diesel engined vehicles for these services, the conditions prevailing, except in very special circumstances, are ideal for operation by battery electric vehicles which will meet the specific requirements of these duties, providing the chassis and bodywork is adapted to the service concerned. Battery electric transport, whilst limited in speed and range with the present traction battery design, is ideal for some of the aforementioned duties. The very nature of municipal services calling for multi-stop-start operation with a reasonable maximum distance to be covered each working day makes electric vehicles the obvious choice for such duties. The favourable characteristics of electric vehicles include the following:

1 They are fume-free
2 They are very clean
3 They are silent
4 They will give immediate maximum torque from stationary
5 They are economic in operation and maintenance

In enumerating the foregoing advantages, the first two are very obvious in connection with the fuel source applied. The latter three are interconnected with electric traction design. The electric motor will give maximum torque from stationary and therefore eliminates the necessity of running a petrol or diesel engine at high speeds in order to develop the necessary starting torque. These engines are noisy, involve fast moving parts and additionally a clutch and gearbox or other means of providing smooth power transmission to the road wheels. With electric traction, easy starting is guaranteed, even on the coldest day of the year. From these points it will be appreciated that the battery electric vehicle, with its easy two-pedal operation on the driver type, is an ideal medium for municipal services. Looking back into history we find that electric vehicles were used by local authorities in a limited sphere, for house refuse collection in a few of the major cities in Great Britain during the late 1920's. In relation to the density of refuse to be dealt with at the time, these vehicles operated very successfully, until as late as the mid 1960's. In some cases, night-duties were performed (stressing the importance of silence). During the war period when it was almost impossible to purchase any type of petrol or diesel vehicle for this purpose, electric vehicles, with their very long term depreciation characteristics, (brought about by the lack of fast moving and wearing parts etc.), did a very useful job indeed.

In view of these advantages, the battery electric vehicle manufacturer must decide that the production of specialist vehicles for these services is imperative and is also a very welcome addition to the production of the already popular local dairy and other delivery vehicles.

As a result of surveys and discussions carried out with the co-operation of the chief officers concerned followed by demonstrations of prototype vehicles etc., ideal municipal vehicles have been produced for operation of the following services:

Municipal Vehicles in Services

Street Cleansing

During the past few years local authorities have found it necessary to mechanise street cleansing due to several factors i.e., inability to recruit suitable staff to operate the manual orderly truck system, efficiency, versatility and mobility etc. To this end, experiments were made with the battery electric pedestrian controlled chassis fitted with alternative end-tipping and bin-type bodywork. The capacity and payload of this vehicle is considerably greater than the manual orderly truck and therefore the 'gang system' of street cleansing was employed using either three, four or five personnel, (one acting as driver/collector). Within the local circumstances, this system works very well indeed and is found to be more efficient and economic per mile of road swept. The speed of the pedestrian operated truck is approximately 3 to 3·5 m.p.h. (approx. 5 k.p.h.), which is a brisk walking pace and adequate for duties involving 6 to 8 miles (approx. 10 13 kms.) per working day. When the cleansing duties involve a journey of say 3 to 4 miles (approx. 5 to 6·5 kms.), out to the location before sweeping starts, it is advantageous to provide sub-depots or to arrange to transport the trucks from the centre depot to the location on a low-loading trailer. In some cases, sub-depots are easily available with a power supply and in those circumstances the situation is ideal inasmuch as the gangs

commence their daily 'beats' from this sub-depot and return there each night to unload and to put the truck on charge ready for the next day's work. The collection of the street refuse from the trucks is a matter for the cleansing officer concerned to decide, but several methods are viable, the most convenient one being the arrangement whereby a 'parent' house refuse collection vehicle working in the area or alternatively some other bulk carrier vehicle meets the 'gang' either at the sub-depot or en-route if more than one clearance is desirable during each working day. For this purpose the pedestrian controlled vehicle with twelve very light-weight polythene bins which are verv easy to 'man-handle' in the transfer of the load to the 'parent' vehicle, is ideal. The end-tipping type vehicle is obviously used where it is possible to tip the load directly either at the depot or at a refuse disposal unit.

Pedestrian controlled street cleaning truck in service with the London Borough of Camden

With the expansion of urban areas and the inevitable extra mileage involved and also where the development of sub-depots or the transfer by truck is either impracticable or too costly, later experiments were carried out with a range of driver type battery electric vehicles. Payload and capacities are variable in this range as are the speed and range per charge of the battery. This development allows each 'gang' to operate as an independent unit proceeding to their daily 'beat', covering the necessary cleansing duty and returning to the depot having disposed of the refuse without involving a 'parent' vehicle.

In at least one local authority in the U.K. as a result of the inability to obtain the services of suitable men for street sweeping purposes, a new approach was made to this problem and it was decided to employ women in this capacity. The electric vehicle was simple to operate, very clean and contained a five crew cab with washing facilities etc. This allowed a gang of five females to do a complete day's work ' in the field '. The cleansing officer concerned reports that this experiment proved in the main to be successful.

Specialised Gully Cleansing

As an extension of street cleansing there is the specialised gully cleansing duties. In the development of new towns, shopping centres and housing committees it is becoming a practice to make certain sections ' no transport ' areas where officially these streets, fore-courts and access areas are reserved for 'pedestrians only'. Obviously it is necessary to have gullies built into the roadworks and these need to be cleaned out and serviced regularly. Again, battery electric vehicles play a very important part in this service because, they are silent, clean in operation and safe by means of maximum speed, thereby maintaining the principles of providing such amenities. A limited capacity gully apparatus can be fitted on either a pedestrian controlled or small slow-speed driver type chassis which is very capable of providing a clean, silent, hygenic cleansing service in these circumstances.

These same vehicles can and are being used on duties which have similar requirements in multi-storey car parks, amusement parks and the like.

Street Lighting—Cleansing and Maintenance

Again, the very nature of the transport requirements for the cleaning and routine maintenance of street lighting, demand the multi-stop-start characteristics which again can be fulfilled by both pedestrian controlled and driver type electric vehicles, fitted with suitable turntable or hydraulic platforms. Hourly operating costs on electric vehicles doing routine cleaning and servicing are approximately one third of the cost of employing petrol engined vehicles on similar application.

Road Repairs and Maintenance

There are many duties connected with the minor repairs and maintenance of pavements, roads and their auxilliary signs etc., which can be effectively carried out by both pedestrian controlled and driver type electric vehicles. Gangs of one or two persons can carry out minor repairs to tarmac roads and pavements, road signs can be cleaned or painted, traffic lights and other illuminated signs can be cleaned and maintained, replacement bulbs etc, fitted as necessary. All the materials and tools can be carried on the vehicle and it becomes a completely mobile unit which does not have to rely on a van or haulage lorry etc., with the added cost of a driver/attendant.

At least one authority in the U.K. is using a pedestrian controlled truck for 'white lining' duties on the roads within the town boundaries. The truck again carries all the necessary items for this chore.

A driver type electric vehicle can be fitted out as a mobile workshop providing power operated drills and tools using the battery as a power source.

Other Services

Similar maintenance, repair and cleaning duties are to be found in parks, sports grounds and recreation centres etc. Further extensions of the use of electric vehicles are being considered for the future and these included transportation of personnel, disabled people etc., as part of the social service to the community. Pedestrian controlled trucks are at present in use by two local authority homes for crippled children and enable a nurse attendant to take up to six children out

for short outings either in the grounds or in the surrounding areas. Again this allows such outings to be arranged at almost anytime and does not involve the provision of a petrol engined mini-bus or similar with its driver and higher operation cost.

Conclusion

The examples given are but just a few of the many municipal services which can be better provided by electric vehicles.

Each vehicle, having carried out a very useful and hard day's work in the service of the community, proceeds to its depot or garage for a battery re-charge overnight. The electricity required for this purpose is surely a very welcome 'off peak' load for the electricity supply service.

ELECTRIC BUS ENTERS SERVICE IN LEEDS

Crompton Leyland Electricars Ltd. of Tredegar, Mon, jointly owned by Hawker Siddeley Group and British Leyland Motor Corporation, has designed and built two 26-passenger prototype electric buses for the Department of Trade and Industry.

The first vehicle went into service on loan with Leeds City Transport in March and the second was shown in Brussels in the same month to European electricity supply authorities.

The production of these two buses represents a further step in the development of battery electric vehicles.

The Department of Trade and Industry is arranging for a number of local transport undertakings to operate these vehicles in their own particular conditions, especially in city centres where amenity considerations are important.

Towns and cities where the bus will be evaluated during the next twelve months include:

Liverpool	(Merseyside Passenger Transport Executive),
Bournemouth	(Bournemouth Corporation Transport),
Birmingham	(West Midlands Passenger Transport Executive),
Sheffield	(Sheffield Transport),
Bolton	(SELNEC Passenger Transport) Executive Northern Company),
Glenrothes, Fife	(Glenrothes Development Corporation).

The exact dates will depend on how long vehicles spend with each transport authority.

Use in service will permit full evaluation of the vehicles and will give operating and technical data. The information obtained will provide a basis for future vehicle specifications.

The two buses provide seating for nine with standing space for 17 passengers and room for hand luggage. This layout is expected to meet most demands. Alternative arangements are possible to suit individual user's requirements.

The fully laden vehicle will have a range of about 35 miles per battery charge in city centre traffic rising to 70 miles when driven non-stop. Top speed on level ground is about 25 mph, which should be adequate for most built-up areas.

Bus construction is based on conventional electric vehicle practice and standard components have been used where possible. Doors are power-operated and heating is provided by two block thermal storage heaters.

The overall dimensions are 22ft. long by 8ft $1\frac{1}{2}$in. wide by 9ft 6in. high with a gross vehicle weight of $9\frac{1}{2}$ tons, unloaded weight is $7\frac{3}{4}$ tons. (6·8m × 2·5m × 2·9m, gvw 7874 kg. ulw 9652 kg.)

The chassis is a British Leyland commercial type (900 FG) modified for electrical propulsion. Twin rear wheels are fitted. The wheelbase is 13ft.4in. (4·1m) and the brakes are power-assisted.

Energy is provided by lead-acid traction type batteries 110 cells (220 volts) 376 Ah capacity at the five-hour rate. These would normally be recharged overnight and can be replaced quickly with a spare charged set to extend the daily mileage.

Propulsion is by a dc series-wound motor continuously rated at 24 hp at 1350 rev./min. driving through a conventional propeller shaft and differential to the back wheels. The vehicle is varied by a low-loss thyristor controller.

Public opinion is showing a growing interest in a reduction in air pollution and noise. Crompton Leyland, the largest manufacturer of electric road vehicles in the world, believe that battery electric vehicle will find an ever increasing place in society.

Enquiries regarding the loan of the vehicle for evaluation are invited from Public Service Vehicle Operators, and should be addressed to Vehicles and Mechanical Enginering Products Division, Department of Trade and Industry, Room 729, Abell House, John Islip Street, London, SW1.

BOOK REVIEWS

A Provisional Code of Practice for Disposal of Wastes
The Institution of Chemical Engineers. £2·00 post free

A provisional Code of Practice for Disposal of Wastes prepared by The Institution of Chemical Engineers has now been published. The Code of Practice is a guide for waste producers, carriers, disposal site operators and waste processers, as well as local authorities, police and others concerned with applying the Deposit of Poisonous Waste Act.

The Act has the teeth to penalise bad practice. The Code sets out what is good practice. Although the standards which the Code requires of waste producers and others are stringent, the requirements are practical and easy to understand.

The working party which has produced the Code of Practice was set up last December by the Engineering Practice Committee of The Institution of Chemical Engineers under the chairmanship of Dr. Leslie Streatfield.

Introducing the Code in London on 17 April, 1972, he said: "The Royal Commission on Environmental Pollution alerted us to the urgent need to establish standards of good practice in the disposal of wastes.

"The standards we have set for the removal, processing and disposal of wastes to land and sea are those which waste producers require to discharge their responsibility. We have given them an objective policy within which to take practical steps. The standards are stringent, but we believe they are attainable.

"The working party agreed unanimously that more wastes could and should be processed instead of being dumped. For example, cyanide wastes can be rendered safe. Hazardous wastes can often quite easily be kept separate from other wastes and therefore processed economically.

"We hope that companies will look at their methods and their wastes and develop rational policies to reduce hazards.

"The specialised carriers, contractors and site operators have a vital part to play. The Code of Practice gives them advice and guidance on how to deal with the collection, transportation, processing and disposal of wastes within the overall requirements we have set, in the context of the moral responsibility to the general public of all concerned.

"If wastes are processed and incinerated, the amount for disposal is reduced. There is an advantage in storing ash from incinerated material if it has a heavy metal content, instead of dumping it."

Turning to the dumping of hazardous material to land, Dr. Streatfield said, "There is a long term danger of water supply contamination. In our present state of knowledge can we forecast the extent of such contamination? The working party felt not. This is why the Code places such severe restrictions on depositing hazardous wastes to land sites."

The introductory memorandum to the Code of Practice explains the reasoning behind the Code's provisons and offers some important general advice to companies.

It points to the lack of statutory requirements relating to the transport of wastes by road. It says that many potentially hazardous materials can be broken down into non-hazardous products and affirms the practicability of treating cyanide in this way. It says that some wastes normally regarded as non-hazardous may nonetheless be dangerous—including domestic refuse, which can include insecticides and spray cans.

The Code of Practice defines hazardous wastes as explosive, inflammable, oxidising, poisonous, infectious, corrosive or radio-active. It classifies them as solids or liquids.

The Code contains examples of forms to simplify the paper work which it specifies.

Waste Producers are made responsible for
- classification and separation of wastes into categories;
- full disclosure of the nature of the wastes;
- satisfying themselves that their own employees and any contractors are able to and will conform to the Code of Practice.

Waste Carriers are responsible for
- ensuring that only such wastes as are properly accounted for by the Waste Producers are carried;
- ensuring that their equipment is appropriate to the wastes to be carried and their employees adequately trained;
- giving instructions (written where hazardous wastes are concerned) regarding route, destination and emergency procedures;
- marking vehicles with symbols and in plain language to show the potential hazard of the load.

Waste Disposal Site Operators are responsible for
- accepting only such wastes as are properly accounted for by the Waste Producers and Waste Carriers;

— maintaining records of all disposals for ten years;
— fencing sites for the protection of the public (particularly children) and also stray animals;
— in the case of disposal to sea, obtaining prior approval from the Ministry of Agriculture, Fisheries and Food and complying with international conventions.

Waste Processors are responsible for
— operating sites in accordance with permissions granted by the appropriate authorities;
— security of site, from the point of view of public safety;
— maintaining records for ten years;
— obeying the same conditions as Waste Producers for the disposal of residual products.

All are responsible for
— training their staff and instructing them to comply with the Code of Practice.

The Society welcomes the production of this code so quickly when it is most needed.

Reader Enquiry Service No. **7232**

Introduction to the Scientific Study of Air Pollution

Edited by B. M. McCormack. D. Reidel Publishing Company/Dordrecht—Holland, pp. 169

Unlike most other texts, such as the meteorological sections on some of the recent giant tomes on air pollution, this one takes us a long way in a few pages. It leaves out the usual bread and butter aspects of meteorology which can already be found in many textbooks and makes a contribution of its own which is both worth while and reliable.

The editor and seven colleagues have covered the subject in a stimulating and informative way. They have set down, for example, much of what is commonplace among workers in air pollution but which is only in papers and reviews—not in ordinary textbooks. This is a very worthwhile job and we can be grateful to these authors for doing it.

Although it is called, correctly, an introduction, the subject has expanded so much in recent years that there are corners of it which even experts are not well informed about, and it is useful to have so much elementary detail, including historical perspectives, arranged as interesting narrative.

There are places where I would differ from the authors in the emphasis I would give to aspects most familiar to me, but air pollution is such a complicated subject that it is almost a collection of individual case studies. This being so, our viewpoints are very much determined by our personal experience and so the choice for an elementary text becomes difficult. As soon as the bare minimum has been set down any more is bound to be personal choice. One might complain if a distorted viewpoint emerged, but this collection of chapters is good sound basic reading, and well balanced.

It is a very suitable book for Local Government Officers as well as for students in any scientific discipline, whether mathematics, physics, chemistry, biology, or geography: there is something specially for each and something from each for the others.

The references and bibliographies are far too voluminous and would have been more useful if more discriminating. After all, a scientific fact or idea is never the exclusive property of one author, and which particular reference is used often does not matter. Also, if the essential idea is given in the text there is no need of the reference, whereas if only the barest conclusions are given an original paper may be needed by the sceptic.

Perhaps the only substantial complaint about the book is that many quotations from the literature are made as integral parts of the sequence of argument yet one often remains very unsure how valid the original paper was. Even these authors' opinions would be better than mere statement of what the original writer 'found'. I think, however, that this is the criticism which the mathematician/physicist feels of much writing in biology/geography, and it does not apply so much to the mathematical and physical parts of the book. Chemists are somehow in between—less systematic than the physicist but more quantitative than the biologist.

The editor in the present case has a gay style, and his book deserves success.

R. S. Scorer

Reader Enquiry Service No. **7233**

Environmental Legislation

William D. Hurley. Charles C. Thomas, Illinois, U.S.A. 1971. $6.50.

This book provides a detailed description of the major laws in the U.S.A. which deal with pollution. Most of the book deals with air and water pollution, explaining the legislation enacted by Congress to deal with the problem and an evaluation of how well the legislation has worked in practice. Two other chapters deal respectively with the problem of solid waste disposal and on the Nixon administration's environmental policy.

A clearly-written, informative book, in which descriptive material is kept to a minimum, the emphasis being on legislation and how it works.

Reader Enquiry Service No. **7234**

Domestic Solid Fuel Smoke Measurement

British Standards Institution. Price £1·00

As part of the British Standards Institution's effort towards the abatement of smoke pollution, BS 3841—Method for the measurement of smoke from manufactured solid fuels for domestic open fires, was issued in 1965. BS 3841 is now reissued with metric units replacing those previously employed, but without any other technical change.

Reader Enquiry Service No. **7235**

The Eco-Activists

Michael Allaby. Charles Knight & Co. Ltd. Price £3·00 hard cover. £1·25 soft cover.

This book gives an overall picture of what is happening in the field of "ecology action" and what young people and those who support them feel, believe and do to try and help avert future environmental pollution. The Society is mentioned in this connection.

The movement by the younger generation to bring to the notice of the public the ever-increasing world-wide pollution problems and how they try to help avert them is explained in great detail.

The book has a wide scope and starts with a prologue entitled "On the Planet Earth, Sepember, 1969. The Unanimous Declaration of Interdependence" and goes on to such chapters as "The Environmental Crisis"; "Ecology Action: Love Our Planet"; "The British Establishment"; "Doomwatch" and many more.

In his conclusion the author says "I think there can be no doubt that for the latter part of this century, the condition of the environment, and man's relationship to it, will come to dominate our thinking more and more".

This is possibly a good book for students to read as they feature largely in it.

Reader Enquiry Service No. **7236**

The New Battle of Britain. A Conservation Handbook and Directory

H. F. Wallis. Charles Knight, London, 1972. £2·00 hardback, 75p soft cover

This book deals not only with the various aspects of pollution in Britain but how these problems can, and are, being tackled, and by whom. It also includes a chapter on what part the ordinary citizen can play. At the end of each section the legislation and bodies mainly responsible for enforcement is given, plus a "further reading" list. A directory of Societies with details of aims, membership, etc., is included.

A reasonably produced book which advocates action rather than words and is not quite so "alarmist" as some of the many books that have been published on pollution recently.

Reader Enquiry Service No. **7237**

Battle for the Environment

Tony Aldous. Fontana/Collins, 1972. 45p

Yet another book about the environment but Dr. Kenneth Mellanby says in the foreword that "the first thing that needs to be said about Tony Aldous' book is that it is unlike any of the other volumes about the environment which have appeared in such profusion in the last two or three years. It is positive and practical, giving facts about our surroundings. It describes things that have actually happened—not fantasies about the eco-catastrophes that may possibly lie in wait for mankind. It contains accounts of many unfortunate happenings and mistakes, but it is also refreshing to find an author willing to give credit to the authorities when they have taken wise and longsighted decisions."

The author deals with the politics of conservation, describing the beginnings and work of the Department of the Environment and giving case histories of enquiries and planning procedures as they have affected particular localities. Tony Aldous is the Environmental and Architectural Reporter for *The Times.*

Reader Enquiry Service No. **7238**

New additions to the National Society for Clean Air Library, available on loan

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The Tools for Reducing Industrial Air Pollution.

Industrial Gas Cleaning Institute, Inc.

A 10 page brochure which explains in simple terms how a cleaner environment can be achieved through the use of time-proven, existing pollution control equipment.

Approaching the Benign Environment.

It has been brought to our notice by a reader that the above publication is now available from Collier-Macmillan Publishers at 45p.

Warren Spring Laboratory Open Days

The Department of Trade and Industry's Warren Spring Laboratory will hold Open Days on Wednesday, Thursday and Friday, October 11, 12 and 13, 1972. These will be the first Open Days at the Laboratory since October 1969.

In the field of environmental technology the Laboratory is concerned with the measurement and abatement of air pollution, methods of dealing with oil on the sea and beaches, and the treatment of domestic and industrial wastes.

The full range of the Laboratory's research activities will be shown, including, in the industrial field, process control and on-line instrumentation, bulk handling of powders, pastes, and slurries, mineral processing, extractive metallurgy, and catalysis.

Lists are now being compiled for the despatch of invitations, commencing in June. Applications for invitations should be addressed to The Director, Warren Spring Laboratory, PO Box 20, Gunnels Wood Road, Stevenage, Herts SG1 2BX.

Estimates of Air Pollution in the United Kingdom in the Year 1970-71

Table 1

Estimates of Pollution by Smoke and Oxides of Sulphur in Million Metric Tonnes from the Main Uses of Primary Forms of Energy

(*one metric tonne=0·9842 long ton*)

Estimates prepared by Albert Parker, CBE, DSc

Figures for quantities of forms of energy were derived from the Digest of Energy Statistics issued in 1971 by the Department of Trade and Industry

Form of Energy and Class of Consumer	*Quantity of Energy*	*Quantity of Pollutant*
Smoke		
Coal		
Domestic, including miners' coal	20·2	0·64
Railways	0·1	small
Industrial and miscellaneous including collieries	25·6	0·08
	45·9	0·72
Sulphur oxides		
Coal		
Domestic, including miners' coal	20·2	0·45
Electricity power stations	77·2	2·15
Railways	0·1	small
Collieries	1·9	0·06
Industrial and miscellaneous	23·7	0·62
Coke ovens	25·3	0·08
Gas supply industry	4·3	0·03
Low temperature carbonization plants	2·6	0·01
Patent fuel plants	1·5	small
	156·8	3·40
Coke (excluding consumption in gas works and blast furnaces)		
Domestic, including other manufactured solid smokeless fuels	5·3	0·09
Industrial and miscellaneous	4·7	0·08
	10·0	0·17
Oil		
Domestic	3·0	0·02
Industrial and commercial	51·6	2·39
Gas supply industry	3·7	small
Road transport	19·3	0·05
Railways	1·1	0·01
Marine craft (inland)	1·1	0·03
	79·8	2·50
Sulphur oxides overall total		6·07
Hydro-electricity (coal equivalent)	2·6	
Nuclear-electricity (coal equivalent)	9·6	
Natural gas (coal equivalent)	16·3	
Total coal equivalent, including oil at 1 tonne=1·7 tonnes of coal and including petroleum gases	333·3	

The amount of 51·6 million tonnes of oil used in 1970-71 for industrial and commercial purposes is equivalent in heating value to about 87·7 million tonnes of coal, which if used for the same purposes would have produced about 0·26 million tonnes of smoke and nearly 2·4 million tonnes of oxides of sulphur. The total amount of 6·07 million tonnes of oxides of sulphur is 1·82 per cent of the total coal equivalent of 333·3 million tonnes; the total amount of oxides of sulphur in 1969-70 was 1·94 per cent of the total coal equivalent.

Of the 51·6 million tonnes of oil 12·6 million tonnes was used by the electricity power stations.

Table 2

Estimates of Pollutants from Road Vehicles in the United Kingdom in the Year 1970-71 in Million Tonnes

Consumption of Motor Spirit	14·23 million tonnes
Consumption of Derv Fuel	5·04 million tonnes

Pollutant	*Petrol Engines*	*Diesel Engines*
Carbon monoxide	6·7	0·11
Hydrocarbons	0·34	0·021
Aldehydes	0·01	0·003
Oxides of nitrogen	0·23	0·07
Oxides of sulphur	0·025	0·04

The estimated quantity of carbon monoxide discharged into the air from the other industrial and domestic uses of all fuels in the year 1970-71 is about 10 million tonnes including about 4 million tonnes from domestic heating appliances. These discharges are above ground level whereas the discharges from road vehicles are at ground level.

Lead

The quantities of lead in grammes in the lead alkyl compounds added to each litre of the several grades of petrol used in the United Kingdom during each of the years 1960 to 1970 are given in a useful paper by G. S. Parkinson published in the August 1971 issue of the Petroleum Review. From the figures in that paper it is estimated that the total amount of lead in the motor spirit used in the U.K. in 1970-71 was about 9,000 tonnes. The lead would be converted to complex inorganic compounds and about one-third would be retained partly in the lubricating oil and partly in the exhaust system. This means that the amount of lead in the compounds discharged in the exhaust gases from petrol-driven vehicles in 1970-71 was about 6,000 tonnes.

Sampling Stations for Environmental Analysis

A national network of seven environmental sampling stations has now been completed. This network will be used in a programme of sampling and analysis established by Harwell and sponsored by the Natural Environment Research Council. A feasibility study at Lake Windermere was completed in 1971.

The programme will determine the levels of many stable trace elements in air and rain. Variations from background levels will provide information on the passage of trace elements through the environment. In one area —South Wales—the existing sampling station is, in addition to others, set up at the request of the Welsh Office (see their earlier Press notice). These stations will make possible an intensive study of heavy metals in the atmosphere which can be set in parallel with agriculture and public health surveys.

This project, carried out by the Health Physics and Medical Division, Harwell, is an addition to their environmental programme which includes an atmospheric pollution project initiated in 1967; work is also carried out in inhalation toxicology using radioactive tracers, in collaboration with MRC and industry.

Techniques of sampling, analysis and interpretation developed during years of observation of radioactive fallout are being applied in the environmental analysis programme. Other analytical techniques are used as required from the wide range of methods available in Harwell's Analytical Sciences Division.

The stations are sited at Chilton, Berkshire; Lerwick, Shetlands; Plynlimon, Montgomery; Styrrup (Worksop), Notts; Trebanos (Pontardawe), Glamorgan; Windermere, Westmorland; and Leiston, Suffolk.

Elements to be measured include lead, cadmium, nickel, chromium, copper, zinc, cobalt, mercury, selenium, vanadium and arsenic.

National Society for Clean Air

134-137 North Street, Brighton BN1 IRG (Brighton 26313)

President: Stanley E. Cohen, C.B.E., C.C., F.R.S.A.

Immediate Past-President:
Sir Kenneth Hutchison, C.B.E., F.R.S.

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Miss M. George, M.B.E.

Director:
Rear-Admiral P. G. Sharp, C.B., D.S.C.

Divisional Honorary Secretaries:

SCOTTISH
F. J. Feeley, Town Clerk's Office, 78 Cochrane Street, Glasgow (041-221 9600 Ext. 2538)

NORTHERN IRELAND
B.P. Hanna, M.A.P.H.I., Belfast Corporation Health Dept., 16 College Street, Belfast BT1 6BX (41771)

NORTH-WEST
W. E. Pollitt, Health Centre, Crescent, Salford (061 Pen, 5891)

NORTH-EAST
L. Mair, F.A.P.H.I., Civic Centre, Barras Bridge, Newcastle-upon-Tyne (28520)

YORKSHIRE
J. H. Wyatt, Health Dept., 12 Market Building, Vicar Lane, Leeds 1 (30211, Ex. 29)

EAST-MIDLANDS
E. F. Raven, Divisional Inspector, Smoke Control, Public Health Dept., County Borough of Derby, Castlefields House, Main Centre, Derby DE1 2FL (Derby 31111)

WEST-MIDLANDS
F. Reynolds, C. Eng., F.R.S.H., MAP.H.I., M.Inst.F., Public Health Dept., Trafalgar House, Paradise Street, Birmingham B1 2BQ (021-235-3759)

SOUTH-EAST
R. F. Shapter, F.A.P.H.I., Public Health Dept., 8 Easton Street, High Wycombe (High Wycombe 26100)

SOUTH-WEST
J. Barnett, Chief Public Health Inspectors' Office, Metropolitan House (4th Floor), Prince Street, Bristol BS1 4AZ (0272 26241).

SOUTH WALES and MONMOUTHSHIRE
L. Morgan, 9 Lodge Drive, Baglan, Port Talbot (5231)

The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

Membership of the Society and Subscriptions

Membership of the Society is open to any individual, corporate body or local authority. Subscription rates are given below.

Individual Members
Not less than £3. Subscriptions can be paid by Covenant, minimum of seven years at £1.83, the balance being recoverable from the Inland Revenue by the Society. Those Members wishing to pay their subscription by Bankers order or wish to Covenant with the Society are requested to apply for the necessary forms for completion.

Local Authority Members

Population	£	
Less than 25 000	10	appointing 2 representatives
25 001 to 50 000	13	appointing 2 representatives
50 001 to 75 000	17	appointing 2 representatives
75 001 to 100 000	23	appointing 3 representatives
100 001 to 175 000	35	appointing 3 representatives
175 001 to 250 000	40	appointing 4 representatives
250 001 to 375 000	45	appointing 4 representatives
375 001 to 500 000	50	appointing 5 representatives

Over 500 000, £15 and 1 additional representative for each additional 1 000 000 of population or part thereof.

Corporate Members
Not less than £40 (appointing 4 representatives and 2 delegates in each appropriate division) or not less than £23 (appointing 2 representatives and 1 delegate in each appropriate division)

Associate Members
Not less than £3

Note: The Society's subscription year commences 1st April.

National Society For Clean Air

NEWS FROM THE DIVISIONS

NORTH EAST

The Annual Meeting of the North East Division was held on the 13 April, 1972 in the Publicity Centre of Imperial Chemical Industries Ltd at Billingham, County Durham. Delegates assembled for coffee and biscuits at the Agricultural Division Publicity Centre and were given a warm welcome by Mr. F. Whiteley, Operations Director, whose responsibilities in the company included effluent control. Mr. Whiteley was followed by the Works Tour Officer who gave a brief advance account of the arrangements for the coach tour of the works which immediately followed.

After the coach tour delegates assembled to hear a most informative address given by Dr. P. W. Reynolds, Deputy Chairman of the Agricultural Division of I.C.I. Ltd. dealing with the activities of his organisation in reducing air pollution within their field of operations.

Dr. Reynolds began his talk by pointing out that the meeting was being held at a time when the Company's three-year plan of air pollution abatement was nearing completion. He went on to outline the three major problems existing three years ago, viz. dust, SO_2 and ammonia. Since 1969 the nitro-chalk plant had been demolished, the cement plant had been shutdown, the mining and processing of anhydrite had ceased and in March of this year coal ceased to be burned as a fuel. The result was that no less than 98 per cent of all dust emissions had now been eliminated, which, by any standards, was a remarkable achievement. Dr. Reynolds went on to describe similar improvements in relation to SO_2, of which, in 1969, the works contributed 120 tons each day to air pollution most of which came from the two million tons of coal which was used each year. Since natural gas was introduced to the site in August 1970 all boiler plant had progressively been converted to natural gas and the total emissions of sulphur dioxide since 1969 have been reduced by 97 per cent.

The speaker went on to refer to problems of nuisance from ammonia losses, mainly from high pressure plants which leaked at various joints. Old high pressure plants had been shut down well ahead of schedule and leakages of ammonia from this source completely eliminated. Vents from the new low pressure plants had been flared to destroy ammonia and a new scrubber of double the original capacity had solved the problem of ammonia emissions from the area plant. Already the ammonia emissions were well below the 90 per cent reduction target which had been set for the end of this year. Dr. Reynolds went on to refer to fog caused by the reaction of ammonia with SO_2 which in humid weather resulted in fogs which could be very dense and even impaired visibility at Teesside Airport, six miles away. Such fogs no longer occurred and complaints from the airport had ceased.

The speaker also dealt with the creation and treatment of smells, the problem of disposing of the enormous amounts of low grade heat in water vapour and the capital expenditure of pollution abatement which, during the past three years, had topped £3 million. His address was concluded on a somewhat optimistic note associated with the research programme on automobile exhaust purification.

Dr. Reynold's address was followed by a short film entitled "Something to Sing About" which presented in colourful and dramatic form the progress which had been outlined by Dr. Reynolds in his address.

At the conclusion of the film members were invited to assemble for cocktails in the Synthonia Club Main Hall where lunch was served later at the kind invitation of the Company. It was at the conclusion of the film that the meeting was fortunate in having the Director, Rear Admiral P. G. Sharp, C.B., D.S.C., in attendance and immediately after lunch he delivered a brief speech on behalf of the Society in which he referred to the mutual aims of the Society and I.C.I. Ltd. and also expressed appreciation and thanks on behalf of all present for the excellent arrangements and hospitality provided by the company.

After the Director's speech the Annual General Meeting was held which, after the usual preliminaries, began with the Chairman Alderman B. N. Young, O.B.E. delivering an address, printed copies of which were available at the meeting.

The Chairman began by referring to the recovery from the Gloco crisis in 1971 and referred to the disappointment felt because of the crippling effects of the coal miners' dispute which had resulted in a disastrous deterioration of the improved fuel situation. He reiterated the Division's plea for a clear cut fuel policy and expressed great concern about the attitude of certain laggard authorities in "black" areas which have either done nothing or achieved very little in the field of smoke control. He deplored the fact that the Northern Region is virually the bottom of the clean air league so far as smoke control progress was concerned. He continued by referring to the activities of the Steering Committee which had been appointed to reorganise the administration of the Society and to certain recommendations relating to nomination for membership of the Executive Council.

The Chairman concluded his address by referring to changes in the immediate future due to local government reoganisation and expressed the hope that air pollution control would be examined very closely by the major authorities and, in particular, those within the Metropolitan County with a view to making up for lost time.

This address provoked considerable discussion and many views were expressed on the causes of the lack of progress in the Northern Region. In particular it was generally agreed that there was an urgent need for financial assistance from Central Government in dealing with the smoke control programme in the North East Region.

This discussion was followed by the election of officers when Alderman B. N. Young, O.B.E. was re-elected Chairman, Councillor T. P. S. Prudham, J.P. of Felling U.D.C. and Professor P. C. G. Isaac of the Newcastle University were e-elected as Vice-Chairmen, L. Mair of Newcastle upon Tyne re-elected as Honorary Secretary and Treasurer and C. J. Davies, City Treasurer Newcastle upon Tyne was re-elected Honorary Auditor.

The Honorary Secretary then presented his report during the course of which he made reference to pollution from road vehicles, Clean Air Weeks, Arnold Marsh Clean Air Awards, smoke control and laggard authorities and other miscellaneous matters. Discussion was particularly vociferous in relation to smoke control and laggard authorities and it was decided to deal with this as a special matter at the next meeting.

The constitution of the Divisional Council was the next matter dealt with and while the Secretary explained the background of events and circumstances which produced the proposed constitution which had previously been approved by the Executive Council, it was agreed to defer further consideration until the next meeting in view of the effects of the impending local government reorganisation.

At the conclusion of the business meeting tea was served in the Publicity Centre, after which delegates dispersed, thus concluding a very successful and informative occasion.

L. Mair
Hon. Secretary

NORTH WEST

Annual Report 1971/1972

The Annual General Meeting of the North West Division of the National Society for Clean Air was held at the Pembroke Hall, Worsley, Lancashire on Tuesday, 30 March, 1971. The N.W.E.B. organised an exhibition of heating appliances and the following interesting papers were given.

"Space and Water Heating in existing Homes"—by Mr. F. Holland.
"Space and Water Heating in new Homes"—by Mr. T. Potts.
"Air Conditioning and Improved Internal Environment"—by Mr. H. Chippendale.

The speakers were introduced to the members of the division by Mr. C. J. George, Commercial Manager of the N.W.E.B. Members of the division were entertained to cocktails and luncheon by the N.W.E.B. and welcomed to the Meeting by Mr. J. Richardson, Chairman of the N.W.E.B. The divisional council met on four occasions during the year and at the first meeting Mr. R. A. W. Hollingdale, of the N.W.G.B. was elected Chairman of the divisional council and Mr. Lydiate of the solid fuel merchant association was appointed vice-chairman. Mr. H. Cluskie, Chief Public Health

Inspector for Leigh, was elected Hon. Treasurer, Mr. Pollitt of Salford was elected Hon. Secretary. However, during the year, Mr. Lydiate changed his employment and was no longer eligible to retain his appointment of vice-chairman of the North West Division. Mr. L. Goodman of the National Coal Board was elected in his place as vice-chairman for the remainder of the year.

The work of the North West Division during the year has concerned itself with Local Government Re-organisation and its effect on the National Society for Clean Air. Admiral Sharpe, Director of the National Society for Clean Air was invited to a meeting with the national executive members of the North West Division to explain to the members, reasons for re-organisations of the Society. The views of the North West Divisional Council were that there should be no re-organisation of the Society until such time as local government re-organisation took place, this view was upheld by the national executive.

A report of the Technical Committee of the National Society for Clean Air on sulphur dioxide was also considered during the year and is still under review. Visits to Robinson Willey of Liverpool and Messrs. Glynwed of Audenshaw, Manchester, were made by members of the division where they had the opportunity of listening to the technical members of these firms and observing the construction and assembly of gas fire appliances, both these firms entertained the members to lunch.

The provision of speakers to various organisation i.e. schoolchildren, women's guilds, rotary clubs, church guilds were made during the year. It is interesting to note the general interest with which speakers on pollution are received, it would appear that the general public are now accutely aware of the increasing problem of pollution, whether it be smoke, sulphur or noise.

A quiet year generally with the unfortunate occurrance of the strike in the mining industry during the winter periods. Let us hope that the ensuing year will bring more progress so that smoke control areas and the adjoining authorities will now begin to link up and make a continuous area of smoke control.

It is also hoped that all Local Authorities, particularly those where little progress has been made since the commencement of the Clean Air Act of 1956 will now move a little quicker and reduce their emission of smoke SO_2 into the atmosphere so we may all breathe cleaner air.

W. E. Pollitt
Hon. Secretary

CLEAN AIR SPRING SEMINAR

The first Clean Air Spring Seminar was held at the Grand Hotel, Manchester, on 22 and 23 March, 1972. The Seminar was opened by the Lord Mayor of Manchester, Alderman D. J. Edwards, at 9.30 on Tuesday, 22 March. This opening ceremony at which the President took the chair lasted only 15 minutes and so the first technical session was soon under way.

The first session dealt with the Disposal of Wastes, and Mr. Neil Iliff, C.B.E., a member of the Royal Commission on Environmental Pollution, certainly got the Seminar off to a very good start. Four papers on incineration followed. Mr. K. S. Dunn, the Managing Director of the Incineration Company Limited spoke on "On Site Incineration", and Messrs. W. A. Clennell and C. R. Mowle of Motherwell Bridge Tacol Limited presented a paper on "Centralised Incineration". After a break for coffee, Mr. G. Cheater of the Rubber and Plastic Research Association, spoke on "Incineration of Rubber and Plastic Wastes" and Mr G. Moodie of Head Wrightson Process Engineering Limited presented a paper on the "Incineration of Sewage Sludge".

The session on the Wednesday afternoon was concerned with the Working Environment. Mr. H. G. Mitchell of the Electricity Council, opened the proceedings with a very interesting talk on "Integrated Environmental Design" and this was followed by a general paper by Dr. F. M. H. Taylor of the Institution of Heating and Ventilating Engineers entitled "The Role of the Heating and Ventilating Engineer in Pollution Control". Mr. Peter Swift of Dust Control Limited very kindly travelled all the way from Germany to give an enlightening talk on "Dust Control in Factories" and Mr. R. B. Williamson, the Managing Director of W. H. S. Pathfinder Limited spoke on "Clean Rooms".

The session on Thursday morning considered Dust and Gaseous Pollutants. Mr. C. R. Cresswell of the County Borough of West Bromwich set the scene by discussing "A Practical Approach to the Statutory Control of Emissions" and Mr. C. D. Darley of the County Borough of Birkenhead broke new ground in a paper on "Grit and Dust from Non-Combustive Processes". Papers dealing with the more technical aspect of gas cleaning were then presented. Mr. K. Darby of Lodge Cottrell Limited talked about "High Efficiency Gas Cleaning", Dr. J. Bettleheim and Mr. B. H. M. Billinge of the Central Electricity Research Laboratory presented a paper on "Problems of Dry Processes for Removing Sulphur Dioxide from Flue Gases" and Mr. A. J. Moyes of W. C. Holmes and Company Limited presented a very interesting and informative paper on "Electrostatic Precipitators".

The final session under the chairmanship of Mr. E. W. Foskett of Manchester was devoted to Furnaces and Chimneys. Mr. H. B. Weston of N.I.F.E.S. presented a technical paper on "Boiler Furnace Design Considerations for Dual Fuel Firing", Mr. Max Beaumont of F. E. Beaumont Limited presented a very commonsense answer to the problem of chimneys and Mr. R. P. Braby of Honeywell Limited gave a most interesting talk on "Progress in Automatic Control".

The Seminar was attended by over 170 delegates. All sessions were full and discussion was lively. It served to indicate that there would seem to be a definite requirement for technical seminars of this nature. It is hoped that this may well set the pattern for future events.

"Air Knows No Frontiers"

INTERNATIONAL NEWS

BRITAIN

Britain is sending a strong delegation to the United Nations Conference on the Human Environment. It will be led by Mr Peter Walker, Secretary of State for the the Environment, and will include officials of the Overseas Development Administration.

The Minister for Overseas Development, Mr Richard Wood recently told the Royal Society of Arts in London that Britain sought to ensure that her aid contributions did not have unwelcome consequences for the environment.

He was giving a lecture on the place of British assistance in world development, and said that it was almost certainly no blessing to a developing society to help to quicken its economic growth and at the same time choke its rivers, contaminate its air and destroy its natural treasure.

Britain, he said, had been trying for some years to bring social and ecological factors into her methods of appraising development projects she was asked to finance. But he also made the point that developing countries must be the judges of their own environmental problems which were not necessarily the same as those of the donor nations.

The Stockholm Conference aims to provide for an international agreement of remedial recommendations and one of the items to be discussed will be development and environment.

Here the British view emphasises that there is no fundamental conflict between good development and environmental planning. For many years the well established and continuing work of Overseas Development Administration associated scientific organisation has had strong environmental contents, and their combined budgets at home and abroad runs to about £3·5 million a year. There is also the environmental aspects of work undertaken under ODA's Research and Development schemes, costing another £3 million annually.

Ecological aspects of accepted projects under general capital aid and technical assistance programmes are a further important phase and protection and conservation of the environment are included in family planning, public health, town planning, forestry, fisheries and agricultural aid programmes.

Britain is willing, as in the past, to finance general environmental projects within the general aid programme and to increase that form of aid within the programme. Within expanding overall aid there is room for such requests, but it is up to the developing countries themselves to judge, including the effects of long- and short-term cost to them of one development project against another, within the limits of international agreements to which they might subscribe at Stockholm or later.

NORWAY

In preparing for the Stockholm Conference it was realised by Norwegian as well as other West European environmentalists that some international arrangements would be required to control the spread of pollution problems, particularly of the seas. Consequently in June 1971 a conference on marine pollution was convened in London, this resulted in the Oslo-convention which was signed by 12 countries. This prohibits the dumping of certain toxic materials from ships and aircraft in the North Sea area.

The Norwegian government in reconsidering its internal administration to control pollution is now setting up a new ministry to deal with most environmental problems. This will be called the Ministry for the Protection of the Environment.

When preparing their national report for the Stockholm Conference Norway found that in their case the geographic diversity of the country caused peculiar demographic problems and questions of population distribution. These, together with the rather special climatic conditions and relative scarceness of natural resources posed problems of particular significance. These problems will have to be solved internally. But the measures used may possibly to a large extent be adopted from similar solutions in other countries through international exchange of information.

In the conclusion to their Report to the United Nations Conference on the Human Environment the Norwegian Government say they hope that the Nations participating in the Conference will make specific recommendations for:

(a) General guidelines for natural resources management, including that relating to exploitation of marine life, and providing for international regulations and enforcement procedures.
(b) Widest possible harmonization of national measures for the protection of the environment.
(c) Proper recognisation of environmental aspects in political, social, and economic planning.
(d) International monitoring systems for pollutants.
(e) Introduction of comprehensive bans on the pollution of sea, air, and soil by bioactive substances which do not normally occur in the natural environment.
(f) Introduction of regulatory measures controlling the disposal of harmful substances which already exist in the natural environment.
(g) Establishment of international measures against harmful air pollutants such as sulphur dioxide.
(h) Elimination of international discharges of oil into the sea.
(i) Establishment of an international convention for the protection of arctic areas.

CANADA

Over the past two years, an Interdepartmental Committee within the Federal Government has been guiding Canadian preparation for the Stockholm Conference. The responsibilities of the Committee included the co-ordination of contributions of Conference documentation and representation at various U.N. Working Group and Preparatory Committee Meetings. Task Forces were formed within departments to provide Canadian contributions to specific international Working Groups.

In April 1971, the Canadian Government established a Canadian Preparatory Committee to advise the Government on matters pertaining to the Conference. Preparatory teams within the Canadian Government, aided by the recommendations of, and contributions from the members of the Canadian Preparatory Committee and the concerned public have prepared papers on a number of environmental issues. Fifty-five case studies have been submitted by Canada to the Conference. In addition, Canadian experts have contributed to certain aspects of the Action Plan in five areas of particular international concern. These are: (1) The Declaration on the Human Environment, (2) Monitoring and Surveillance, (3) Marine Pollution, (4) Conservation, (5) Soils.

ECONOMIC COMMISSION FOR EUROPE
Working Party on Air Pollution Problems

Third Session, 7-11 February 1972—Review and Analysis of the Existing Situation and Future Prospects in the Prevention of Air Pollution

At its second session in January 1971 the Working Party decided to include in its programme of work a review and analysis of the existing situation and future prospects in the prevention of air pollution on the basis of up-dated versions of the documents submitted by governments to the Working Party on Air Pollution. In accordance with this decision the Executive Secretary invited governments to submit relevant information. Information was received from the following countries: Austria, Byelorussian SSR, Bulgaria, Hungary, Malta, Norway and Poland. The competent authorities of Cyprus informed the Secretariat that a Cyprus Council for the Conservation of Human Environment has been established; its terms of reference were limited rather to the conservation of the natural environment of the country. A Town and Country Planning Law has also been enacted recently.

AUSTRIA

An Interministerial Committee under the chairmanship of the Federal Minister for Social Affairs has been established for questions of environmental protection including air pollution.

In April 1971, a scientific advisory board for environmental protection was set up under the chairmanship of the Director of the Institute for medical physics of the University of Vienna. Its tasks are the scientific analysis and examination of the measures required in the field of environmental hygiene.

The section for air pollution control of the Federal Bacteriological—Serological Test Institution has been approved as a "National Reference Centre" by the World Health Organization.

The Austrian Academy of Sciences has set up a working group which is dealing with the maximum emission concentrations for sulphur dioxide. Also a working group has been established to calculate and estimate the economic effects of environmental pollution in Austria.

In 1971 amendments to the motor vehicle Act passed by the Austrian parliament in July 1971, contains regulations concerning lead compounds emitted by exhaust gases. A regulation concerning the ventilation of the crankcase and the content of carbon monoxide in the exhaust gases is in preparation.

THE BYELORUSSIAN SSR.

The reduction of sulphur oxide emissions polluting the atmosphere is treated as a priority problem in the Byelorussian SSR. A number of measures are permanently applied to protect the air against pollution by sulphur oxides. All such work, including tests and checks, is managed by the organs of the State inspectorate..

Much emphasis is put on the correct siting of industrial enterprises in the Republic. To ensure more rational siting of industrial enterprises, the workings of the inspectorate impose certain requirements at the time the site is chosen.

Measures are also taken in the Republic to reduce sulphur oxide emissions by existing plants. This is achieved by substituting low-sulphur for high-sulphur fuel, by converting thermal power plants to gaseous fuel, and by the elimination of small boiler houses.

During the period 1969-70 a number of measures were applied in the Republic to prevent pollution of the air by industrial waste and emissions.

Changes occurred in the composition and quantities of fuel burnt in the Republic. Compared with 1968, the amount of peat burnt in 1970 declined by 2,603·8 tons per day. In recent years more than 1,200 industrial and municipal undertakings were connected to centralized heating systems and gas mains.

A great many measures for the purification of the air are to be carried out in the current five-year plan covering the period 1971-1975.

In motor transport establishments comprising more than 500 transport units, points are to be set up for checking the toxicity of exhaust gases and diesel-driven motor vehicles are to be equipped with exhaust gas neutralizers.

BULGARIA

Industrial concentration in Bulgaria is thought to be heavily polluting towns and cities and it is estimated that some 2·5 million people live in areas with atmospheric pollution. Research in the laboratories of the health and epodemiological institutes has established the presence of the following harmful substances and gases: industrial soot, sulphur gas, lead and metal compounds, carbon dioxide, sulphuretted hydrogen, oxides of nitrogen, ammonia, hydrocarbons, dust etc. The major air pollutants are solid dust particles and sulphur gas.

The main sources of pollution are the mineral fuels used in industry, transport and the home, cement factories, metallurgical combines, chemical factories, asphalt bases used in road construction large animal-husbandry complexes, and open cast ore-mining.

During the last 10 years the Institute of Forestry Research has investigated the influence of air pollution on growth in general and the growth of trees and bushes in particular.

In order to reduce air pollution a number of governmental resolutions, Acts and regulations have been promulgated. The most important are: The Protection of Air, Water and Soil from Pollution Act, 1963; The Protection of Air, Water and Soil from Pollution Regulations, 1964; The Protection of Nature Act, 1967; The Protection of Nature Regulations, 1969; Standards for permissible concentrations of harmful substances in the atmospheric air of the country's centres of population; Health classification of productive activities of enterprises, and necessary minimum health protection zones.

HUNGARY

As a result of industrial progress accompanied by extremely rapid urbanization, pollution of the atmosphere presents many problems in Hungary. Although research in this field was begun some time ago because of the higher sulphur and ash content in the fuels used in Hungary, no considerable achievements were realised until the last 10 years.

As early as the 1930s, the National Public Health Institute had an air health department and at an international conference in Paris in 1935 the Hungarian delegation were emphasizing the significance of sulphur contaminations.

On the basis of studies and recommendations the Budapest Air Pollution Control Committee was formed in 1965. In 1968 the planned and organised protection against air pollution became the task of the Ministry of Construction and Urban Development. The consultative body of the Ministry of Construction and Urban Development—the National Air Pollution Control Committee—was formed in 1970. The Committee includes all governmental organs authorized to take protective measures as well as the supervisory authorities of air pollution plants. Committees with a similar composition on a county-scale authority range, have been established by the county councils of areas with the highest degree of air pollution.

A Government decree was passed in 1971 which specifies the standard norms of air quality in a differentiated manner to comply with the requirements of areas intended for different purposes.

As a result of the economic assistance of the legal and technological regulations, the simultaneous changes in the energy structure of the country and the increasing use of hydrocarbons and fuel gases it is hoped that the air pollution situation will greatly improve in the near future.

MALTA

The immediate problem in Malta has been that of visible pollution by smoke from shipping and certain establishments in the area surrounding the Grand Harbour and drydocks complex.

Pollution from other industrial estates is not yet significant but may increase in importance. Pollution from vehicle exhausts is evident at certain peak traffic periods but the overall problem from this source is not as yet important.

The Clean Air Act, 1967, prohibits, except for specified permitted periods, the emission of dark smoke from any chimney. Other provisions stipulate that new furnaces are to be as far as practicable smokeless; grit and dust from furnaces are to be minimized; and smoke "nuisances" are to be abated.

Since the enactment of the Clean Air Act, positive results have been made over the period 1968-1971 towards the control of Malta's immediate problem, i.e. visible pollution by smoke in the Grand Harbour Area.

NORWAY

In 1967 a committee was established to consider the need for a general revision of the Norwegian legislation regarding air pollution. Besides this main work the commitee has issued reports on more specific problems which possibly ought to be solved before the general law revision.

There has been considerable development in most Norwegian industries in the last few years. Of special interest from the point of view of air pollution is the production of aluminium which has greatly increased and as a result strict licence conditions have been laid down particularly with regard to fluoride emissions. Red fumes from steel works has been improved by dust arresting equipment and many other regulations have been established in the fight against pollution.

POLAND

The information received from Poland dealt with the conditions and prospects in the area of air pollution control in Poland in the years 1969-1971.

These are the basic tasks to which the attention of industrial sectors and authorities was directed in that period: The installation of dust-collecting facilities to reduce emission of particulates to the atmosphere from industrial sources; the development of research programmes and scientific background to solve the following problems: (i) emissions of excessively harmful gases from industrial sources; (ii) compiling information on the adverse effect of contamination of the atmosphere caused by the use of specific technologies and especially by aluminium and copper works and the production of nitrogen and sulphur on the environment and public welfare; development of the monitoring network to obtain better information on the air pollution caused by particulates and sulphur dioxide in towns and industrial centres; and the development of air pollution control services in industrial sectors at government level.

CZECHOSLOVAKIA

The Economic Evaluation of the Effects of Air Pollution in Czechoslovakia. Mr. V. Voracek

The problem of assessing damage due to atmospheric pollution and its economic evaluation in Czechoslovakia is treated as part of the research work co-ordinated by the Federal Ministry for Technical and Investment Development. The Geographic Institute of the Czechoslovak Academy of Sciences conducts research into the methods of evaluating the positive, as well as negative effects of economic activity on the geographic environment.

In the whole range of damages due to the negative effects, the largest proportion is ascribed to the effects of atmospheric pollution of the environment which affects in varying degrees all aspects of the geographic environment. The increasing rate at which atmospheric pollution

is developing and the accumulating damage which this creates, makes it even more imperative to deal with the problem of economic evaluation. In industrially developed countries atmospheric pollution and its consequences have become a problem at the level of the national economy and in settlements and industrial agglomerations it affects the field of social and economic questions. Since the area of the territory affected by atmospheric pollution has reached geographic dimensions, it is necessary to treat the problem of evaluating damage done to the environment by applying the research methods of special geographic disciplines. Without data on the economic consequence of atmospheric pollution it has become impossible in Czechoslovakia to deal with problems arising from the complex development of regions, to plan the distribution of large investments, and in particular the location of industrial plants. These are the reasons for which considerable attention is being devoted to this topical problem not only in research, but also in planning, in state administration and in production.

Research is being conducted in certain representative regions of Czechoslovakia selected as a result of discussions between experts from various research, planning and administrative establishments. In each model region a list (register) has been drawn up of all sources of atmospheric pollution describing the characteristics of the technological process and the emitting installation. On the basis of a detailed study of the mezoclimatic conditions and on data on concentrations of emissions and immissions, this investigation into the extent and intensity of damage is being carried out with the following objectives:

(a) An evaluation of the effects of damage on population.
(b) An assessment of the effects of damage on animals.
(c) An assessment of the effects of damage on metal constructions, buildings and equipment.
(d) An assessment of the effects of damage resulting from the pollution of the atmosphere by gaseous and solid emissions, changes in some of the mezoclimatic factors, radiation, occurrence of fog, thermal stratification, etc.
(e) An assessment of the effects of damage on agricultural production with respect to plant production.
(f) An assessment of the effects of damage on forest growths.
(g) An atmospheric protection control system.

YUGOSLAVIA

The Economic Effects of Air Pollution in Yugoslavia. Dr. R. Feliks

Together with the increasing industrial activity, which has reached gigantic proportions, and the ever increasing traffic development and fuel consumption for household use, the quantity and variety of wastes that are emitted into the atmosphere have also increased.

Air pollution causes manifold damage to man. Primarily it imperils his health and life and then the property he possesses. As air pollution causes damage to the environment, it constitutes a danger to man's own survival and the security of all living creatures as well. Therefore the protection of the atmosphere and the environment requires urgent and effective control.

Measures for the control of the environment and of air pollution involve large investments. That is why before reaching any conclusions about the steps that should be taken, the economic effect should be examined and the cost taken into consideration.

But the question of cost should never arise when man's health and life is at stake.

It is relatively easy to evaluate the protection of the atmosphere but it is much harder to estimate the damage air pollution causes to man's health, his possessions and surroundings.

The economic effects of air pollution are manifested in two ways: (a) the effect of air pollution on man's health, and (b) the effect of air pollution on his property and surroundings and the deterioration of nature.

The economic effects of air pollution on man's health can be examined in two ways:

(1) as direct expenses arising from the damaging effects of air pollution;
(2) as expenses arising from the need to provide more sanitary conditions for the present and protection for future generations.

For the economists the environment does not have a general value. Their economic values are relative, and dependent on man's use. The value of the environment is not estimated but its functions are.

The air is a universal good, but usually one must travel over 20 km out of a populated area in order to find clean air. In this case it is necessary to build roads, to maintain them, to use means of transportation, and all of this costs money.

On the other hand a polluted atmosphere causes damage to the health of every individual; it causes headaches, bronchitis, lung cancer, and it also reduces work capabilities and all of this costs money.

This is why the question arises of whether it is more economical to gain recreation by going out into clean air or to suffer losses due to frequent illnesses.

Air pollution destroys the greenery and pollutes water which causes disruptions in the normal biological balance.

The consequences are many:

— the greenery produces oxygen and prevents floods; it provides food for many animals and thus affects the production of meat, milk and milk products.
— in water which is polluted through air, plankton, the main producers of oxygen and the main suppliers of food for fish, are destroyed.

As it can be seen polluted air has many consequences for man so an economic evaluation is not so simple.

Nature, in general, fulfils many functions in man's life and destroying her has economic consequences. It is very hard to estimate all of these functions and give them a price.

The economic effects of air pollution on animals can be worked out in two ways:

(1) By the difference between the reproduction of animals that are exposed to air pollution and those that are not exposed to air pollution. It is known that the fertility of animals exposed to air pollution is diminishing (for example, sheep become sterile when exposed to the damaging influence of lead).

(2) By the difference in weight of animals exposed and those who are not exposed to air pollution.

Construction material which is exposed to air pollution, especially to acid aerosols, corrodes and wears out more quickly. The increase in expenses arising from the renewal of construction material may be taken as the economic effect of air pollution.

The emissions of gases and dust into the atmosphere also presents an economic loss.

In many cases it is economically useful to retain SO_2 and transform it into sulphuric acid. Large amounts of dust, lead, antimony, cement etc. can be retained and used.

Many factories emit into the atmosphere a great amount of air pollution, and the agricultural districts around them are completely destroyed or their production is greatly decreased, as is the case for the districts around the copper-smelting house in Bor. The difference between the yield in these areas and the average yield, represents a loss.

The differences between the yields of orchards or the increase in forest trees, which are exposed to air pollution and those which are not, represent the losses in yield.

The difference between the increased necessities for the maintenance of cleanliness in cities exposed to air pollution, and those where there is no air pollution, represents the increased expenses incurred by air pollution. Only families with similar social rank and composition should be questioned.

Within the framework of follow-up and control of air from air pollution, it is necessary to analyse the following expenses:

A. Follow-up

(1) Personal expenses of the staff that participate in collecting samples of air for the analysis, or for those that work in laboratories for analysis of air.
(2) Material expenses—the value of the equipment which is used for taking samples and analysing the air. Chemicals and other materials.
(3) Functional expenses—transportation expenses.

B. Control

(1) Personal expenses of the inspection service.
(2) Price of equipment used.

All this information used to estimate the economical effects of air pollution would be collected through surveys:

(1) in areas exposed to different types of air pollution, separately for every type (survey of populated areas).
(2) in areas which are not exposed to air pollution but are similar in composition, environment, population, economic activity and national income which they realize (control groups).

The average prices of individual goods in the country would be used for estimating the value of the increased expenses.

Air Pollution Control

The Industrial Gas Cleaning Association (IGCA) was formed in the second half of 1971 and is composed of the five founder members listed below, who have been involved in the control of air pollution for a number of years:

W. C. Holmes & Co. Ltd.,
Howden Group Ltd.,
Lodge-Cottrell Ltd.,
Sturtevant Engineering Co. Ltd.,
SF Air Treatment Ltd.

The objects of the Association are to advance the technology and safe practices relating to the manufacture and operation of plant and equipment for the cleaning of industrial effluent gases. The Association has the expertise and the specialised techniques to investigate processes which emit fume, dust and noxious gases and propose solutions. All members of the Association are concerned with the manufacture and supply of electrical precipitators, bag filters, scrubbers and mechanical collectors on which its members have accumulated a combined experience unsurpassed anywhere in the world. The Association is represented on the Executive Council of the National Society for Clean Air and will advise and contribute on methods for the elimination of pollution of the atmosphere.

Those who are interested in obtaining technical advice and guidance on this subject or are interested in the installation of equipment to eliminate air pollution should communicate with the Association at its offices, Dickens House, 15 Tooks Court, London EC4A 1LA, to whom they are also invited to submit their technical problems for consideration and discussion by the members of the Association.

SMOKE CONTROL AREAS

Progress Report

Position at 31 March 1972

(Figures supplied by the Department of the Environment)

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 1.1.72 ..	3,580			8			181			37		
Acres		1.024,850			1,097			96,966			9,400	
Premises			5,023,307			4,979			447,800			19,611
Smoke Control orders Confirmed (1.1.72-31.372)	91			—			1			5		
Acres		33,315			—			262			732	
Premises			145,368			—			1,022			1,931
Totals	**3,671**	**1,058,365**	**5,168,675**	**8**	**1,097**	**4,979**	**182**	**97,228**	**448,822**	**42**	**10,132**	**21,542**
Smoke Control Orders Submitted (1.1.72-31.3.72)	110			—			6			4		
Acres		42,512			—			2,683			528	
Premises			147,601			—			11,503			3,081
Grand Totals	**3,781**	**1,100,877**	**5,316,276**	**8**	**1,097**	**4,979**	**188**	**99,911**	**460,325**	**46**	**10,660**	**24,623**
Smokeless Zones (Local Acts) in operation	44			—			—			—		
Acres		3,400			—			—			—	
Premises			41,060			—			—			—

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND
at 31 March 1972

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	46,108	36·8	186,524	33·7
Yorkshire & Humberside	211,392	56·1	707,007	60·5
East Midlands	76,789	28·6	232,530	45·4
Greater London	271,021	82·9	2,307,167	87·4
North Western	216,377	53·9	906,957	53·3
West Midlands	93,957	37·7	428,770	40·8
South Western	7,505	28·5	28,697	19·3
Total (black areas) ..	919,904	51·9	4,758,358	61·2
Outside black areas ..	180,963		557,918	
Grand Totals	**1,100,867**		**5,316,276**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke-control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Spring 1972)** *which gave the position up to* **31 December 1971.** *They now show changes and additions up to* **31 March 1972.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Tyneside and Wearside

Jarrow B. (No. 5).

Local Authorities Outside the Black Areas

Stanley U.D. (Durham) (Dipton No. 2).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Tyneside and Wearside

Boldon U.D. (No. 19). Blaydon U.D. (No. 4). Workington B. (Clay St. No. 1).

Teesside

Hartlepool C.B. (No. 22). Teesside C.B. (No. 9).

Yorkshire

West Riding (North)

Bingley U.D. (No. 17). Brighouse B.C. (No. 19). Leeds C.B. (Nos. 96, 97 and 98). Stanley U.D. (No. 5). Wakefield B.C. (Flanshaw No. 2). Elland U.D. (No. 3). Horsforth U.D. (No. 32).

West Riding (South)

Rawmarsh U.D. (No. 1).

North Western

South Lancashire and North-East Cheshire

Ashton-under-Lyme B.C. (No. 12). Bolton C.B. (Rumworth No. 2 and Bradford and Derby Wards). Horwich U.D. (No. 4). Stretford B. (No. 15). Failsworth (No. 10). Kearsley (No. 5). Westhoughton U.D. (No. 7). Worsley U.D. (Linnyshaw Pt. 2). Manchester C.B. (Butler Street; Oxford Road; Irk Valley; Lecester Road; Stockport Road; New Cross and Livesey Street) Worsley U.D. (Wharton No. 11).

Central Lancashire

Darwen B.C. (Nos. 9 and 10). Preston C.B. (No. 24). Padiham U.D. (No. 12).

Merseyside

Ellesmere Port B.C. (Nos. 11 and 12).

Midlands

Derby, Nottingham and Chesterfield

Chesterfield R.D. (No. 13). Beeston and Stapleford U.D. (No. 13). Carlton U.D. (No. 10).

North Midlands

Leicester C.B. (No. 30).

West Midlands

Sutton Coldfield B.C. (Nos. 22 and 23). Dudley C.B. (No. 59). Stourbridge B.C. (No. 28). Halesowen B.C. (Nos. 34 and 35).

Potteries

Newcastle-under-Lyme B. (No. 9).

London

Greater London Borough

Kingston-upon-Thames L.B. (Nos. 20 and 21). Lambeth L.B. (No. 26). Merton L.B. (Nos. 20, 21 and 22). Hillingdon L.B. (Nos. 7, 13 and 14). Newham L.B. (No. 8). Wandsworth L.B. (No. 5). Southwark L.B. (Nos. 27 and 28). Sutton L.B. (No. 25). Barnet L.B. (No. 13). Bexley L.B. (No. 12). Enfield L.B. (No. 18). Harrow L.B. (No. 25).

Local Authorities Outside the Black Areas

Easington R.D. (Peterlee No. 2). Exeter (Hamlin Gardens and Barton). Skipton U.D. (No. 8). Blaby R.D. (Braunstone) Bletchley (No. 1). Luton C.B. (No. 9). Marple U.D. (Nos. 3 and 5). Seisdon R.D. (No. 2). Meriden R.D. (No. 6). Northampton C.B. (Nos. 3, 6 and 7). Oxford C.B. (No. 11). Scunthorpe B.C. (No. 9). Slough B.C. (No. 14). Swadlincote U.D. (No. 3). Basildon U.D. (No. 9). Crawley U.D. (Pound Hill). Doncaster R.D. (No. 1). High Wycombe B.C. (No. 18). Whiston R.D. (Rainhill No. 2 and Knowsley No. 2).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Tyneside and Wearside

Gosforth U.D. (No. 2). Wallsend B.C. (No. 6).

Teesside

Teesside C.B. (No. 9A).

Yorkshire

York C.B. (No. 3).

West Riding (North)

Leeds C.B. (Nos. 99, 100, 101 (Burmantofts, Nowell), 102 (Burmantofts, Ashley R.D.) and 103 (Harehils, Harehills R.D.). Mirfield U.D. (No. 12). Sowerby Bridge U.D. (No. 10). Morley B.C. (No. 44). Stanley U.D. (No. 3).

West Riding (South)

Conisborough U.D. (Nos. 2, 3 and 4). Rotherham C.B. (Greasborough No. 3 and Doncaster R.D. No. 1). Darton U.D. (Nos. 19, 20, 22 and 23). Dearne U.D. (No. 8). Wath-upon-Dearne U.D. (No. 5). Harrogate B.C. (No. 1).

North Riding

Saltburn and Marske-By-The-Sea U.D. (Nos. 2 and 3).

North Western

South Lancashire and North East Cheshire

Wigan C.B. (No. 8). Droylsden U.D. (Nos. 15 and 16). Heywood B.C. (No. 11). Oldham C.B. (Nos. 22 and 23). Royton U.D. (Nos. 8 and 9). Radcliffe B.C. (No. 7). Atherton U.D. (No. 7). Rochdale C.B. (Mayfield & Halifax R.D.). Dukinfield B.C. (Tame Valley No. 6). Tottington U.D. (No. 4). Manchester C.B. (Charlestown). Ashton-under-Lyne B.C. (No. 14). Bolton C.B. (East and West Wards).

Central Lancashire

Barrowford U.D. (No. 5). Fulwood U.D. (No. 3). Colne Valley U.D. (No. 1). Burnley C.B. (No. 1). Accrington B.C. (No. 71). Preston C.B. (No. 25). Brierfield U.D. (No. 6).

Merseyside

Birkenhead C.B. (No. 9—Thingwall). Bebington B.C. (No. 15).

Midlands

Derby, Nottingham and Chesterfield

Buxton B. (Fairfield No. 1). Sutton in Ashfield U.D. (No. 1/1971). West Bridgford U.D. (No. 1). Carlton U.D. (No. 9). Hucknall U.D. (No. 4). Arnold (No. 5). Derby C.B. (No. 23 Mickleover and No. 24 Friar Gate).

West Midlands

Aldridge-Brownhills U.D. (No. 34). Birmingham C.B. (No. 160). Walsall (No. 15). West Bromwich C.B. (Nos. 20 and 21). Sutton Coldfield B.C. (No. 21). Dudley C.B. (No. 60 Sedgley South).

Potteries

Stoke on Trent C.B. (No. 25).

London

Greater London Borough

Brent L.B. (No. 11 Brentside and No. 9 Queensbury). Havering L.B. (No. 6). Croydon L.B. (No. 14). Merton L.B. (No. 23). Bromley L.B. (Penge East and Nos. 16, 17 and 18). Lambeth L.B. (No. 27). Hillingdon L.B. (Nos. 16 and 17).

Local Authorities Outside the Black Areas

Ramsbottom U.D. (Nos. 4 and 5). Canterbury C.B. (No. 1). Todmorden B. (No. 10). Whiston R.D. (No. 4). Reading C.B. (Nos. 17 and 18). Norwich C.B. (Nos. 2 and 3). Marple U.D. (No. 4). Northampton C.B. (Nos. 4, 5 and 8). Thurrock U.D. (No. 8). Kings Lynn B.C. (Windsor Road; Seabank and Hillington Square). Royal Borough of Leamington Spa (Nos. 11 and 12). Cheshunt U.D. (No. 7). Gravesend B.C. (No. 2). Market Drayton R.D. (No. 2). Runcorn R.D. (No. 6 Stockton Heath). Doncaster R.D. (No. 1). Waltham Holy Cross (Nos. 5 and 6). New Windsor Royal B. (No. 2). Bedford B.C. (No. 7). Cambridge B.C. (No. 3).

SCOTLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Dundee

Downfield East.

Fife County

Glenrothes (Nos. 2 and 3).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Milngavie

Mains Estate (No. 2).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Paisley

No. 11 (Dykebar). No. 12 (Candren) and No. 13 (Barshaw).

Bearsden

No. 4.

Falkirk

No. 10.

Edinburgh

Craigmillar No. 1 (Part 1).

NORTHERN IRELAND
NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Belfast C.B. (No. 8). Craigavon D.C. (No. 2). Lurgan B.C. (No. 4). Holywood U.D. (No. 4). Craigavon D.C. (No. 1, Variation).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Ballymena B.C. (Nos. 2 and 3). Belfast C.B. (No. 10). Castlereagh R.D. (No. 6).

Crawley Urban District Council

The Department of the Environment has confirmed the Pound Hill Smoke Control Order which will come into operation on the 1st October 1972. This completes the Council's programme for smoke control throughout the whole of the Urban District Council and Crawley is now the only Authority south of the Thames, other than certain London Boroughs, to have completed its programme and the only Authority in Sussex to have made smoke control orders. The Society congratulates Crawley U.D.C. on its achievement.

Royal Burgh of Gourock

The Council of the Royal Burgh of Gourock recently agreed to start a Smoke Control Programme. The first areas should come into operation this year and it is hoped to complete the scheme by 1976. This is the culmination of a lot of hard work by some members of the Council and they are to be congratulated on their foresight and persistence.

AIRBORNE PARTICLES

So someone in Sydney blames air pollution for making women "irritable and at times unbearable." A 64-year-old alderman of that city says that the pollution is stimulating the glands of Australian women and turning them into latter-day Amazons whose genes and hormones are running riot. How the alderman comes by this remarkable theory he doesn't say....
Glasgow Evening Times. 18.3.72.

The clean air of Liverpool is doing wonders for the health of its citizens, but it could bring about a strange side-effect—a change in the famous Scouse accent. There has been a marked improvement in the health of the people living in smokeless zones of the city.... Part of the Liverpool accent is caused by catarrh and tonsil and adenoid infections in children. With the introduction of smokeless zones there will certainly be a reduction of this.
Liverpool Echo. 7.4.72.

Cheap "throwaway" cars may go on the American market in the battle against pollution. The cars will be good for only 10,000 to 15,000 miles, a consulting firm has told the United States Government. The firm was called in to prepare a study into anti-pollution measures due to come into effect in the United States by 1976. The measures require 90 per cent reductions in the amount of carbon dioxide, hydrocarbons and nitrogen oxides emitted by cars. Because of the expense of adapting ordinary cars, the study says that cheap vehicles lasting only 10,000-15,000 miles are likely to emerge.
Manchester Daily Mirror. 15.3.72.

AIR POLLUTION ABSTRACTS

SPRING SEMINAR, MANCHESTER, 22nd-23rd MARCH, 1972 ABSTRACTS OF PAPERS

Session One: Disposal of Wastes

Industrial Waste—The Problem of Disposal by N. A. Iliff (Shell Chemicals Ltd.)

The author does not give a comprehensive account with all the appropriate statistics, but dwells on some points which he feels tend to be given less consideration than they deserve. He deals with the historical aspects; industry in relation to people; industrial wastes in the air; industrial wastes on the land; disposal of industrial wastes to water and some thoughts of the future with general conclusions.

On Site Incineration of Industrial Wastes by K. S. Dunn (The Incinerator Company Ltd.)

The author states in his conclusion that whilst there is no doubt that present and future municipad incinerators will burn an increased proportion of industrial waste, the bulk of it will continue to be dealt with by on-site incinerators and industrial waste contractors. Special purpose incinerators are not inexpensive and the economics of gas cleaning in relation to size of plant point to the desirability of large complexes to deal with the waste from a number of factories on centralised sites. Such installations are already in use in America and in Germany and offer many advantages. In any event, the well designed industrial incinerator, whether installed singly or serving a complex, has an increasingly useful role to play in the general improvement of our environment.

Centralised Incineration by W. A. Clennell and C. R. Mowle (Motherwell Bridge Tacol Ltd.)

This paper generally relates to the municipal incineration plant handling domestic and trade solid wastes, with some concluding thoughts on the whole waste disposal field.

Incineration of Rubber and Plastics by G. Cheater (Rubber and Plastics Research Association of Great Britain.)

The author states that having obtained the correct temperature and air volume there is only one factor in which rubber and plastics can be considered in any way different from any other material so far as incineration is concerned. That factor is the range of temperature over which melting occurs and during which burning proceeds relatively slowly. The molten material can and will cause clogging of orthodox fire grates blocking supplies of under grate air. However, techniques are known which permit burning on a solid hearth without under grate air and in these conditions plastics and rubbers can be effectively incinerated.

Incineration of Sewage Sludge by G. Moodie (Head Wrightson Process Engineering Ltd.)

The author discusses the problems of incinerating sludge in a general way, and a typical plant is described. The technical problems which the engineer would be faced with are discussed with possible solutions to these problems. Gas cooling is also discussed on the subject of reducing steam plume and gas cleaning on incineration plants is also mentioned. The paper ends on a futuristic note by considering the combined collection and incineration of sewage sludge and household refuse.

Session Two—The Working Environment

Integrated Environmental Design by H. G. Mitchell (Head of Environmental Engineering, Electricity Council)

The author examines the historic background through which the ideas and principles of integrated environmental design developed, and describes the research programme which was the starting point. From the research programme live projects have been implemented. The concepts and processes of integrated environmental design are, therefore, clearly established and the author states that we may look forward to a future of buildings providing more comfortable and productive working conditions coupled with a reduced energy demand and causing less pollution.

The Role of the Heating, Ventilating and Air Conditioning Engineer in Pollution Control by F. M. H. Taylor (Institute of Heating and Ventilating Engineers Study Group)

A short review of the effect and damage caused by smoke, dust and grit is given, and positive action taken by competent heating and ventilating designers is explained. The overall design of plant to effect maximum fuel economy and minimise fuel consumption is discussed. The substitution of central heating or more efficient appliances for open solid fuel grates; the use of comprehensive automatic controls; the insistence on high standards of building and plant insulation to avoid waste and the proper installation and maintenance of dust extraction plants are all described as contributing towards attaining a cleaner environment. Some aspects of the economics of pollution control are explained and some effects of national energy policy on the work of the engineer in pollution control is described. The paper ends with a résumé of the aspects of combustion of fuels relevant to the work of the engineer.

Dust Control in Factories by P. Swift (Dust Control Equipment Ltd.)

The paper gives a general definition of dust control systems and then describes the prime consituents of nuisance dust control systems in full detail.

Clean Rooms by R. B. Williamson (W.H.S. (Pathfinder) Ltd.)

The author discusses briefly the nature of airborne contaminants then explains the principles of high efficiency air filtration. Classification of clean rooms and the applications of clean rooms and clean room techniques are then discussed.

Session Three—Grit, Dust and Gaseous Pollutants

A Practical Approach to the Statutory Control of Emissions by C. R. Cresswell (County Borough of West Bromwich)

The author refers to the more important statutory provisions of the law relating to the control of emissions, together with comments which are intended to be practical and possibly of use and interest to those whose function is to enforce legislation as well as to the larger majority whose duty it is to comply. The subject is dealt with under two main headings, briefly the control enforced by H.M. Alkali and Clean Air Inspectorate, and then in more detail the statutory powers local authorities have to control emissions.

Grit and Dust from Non-Combustive Processes by C. D. Darley (County Borough of Birkenhead)

From this paper it may be seen that grit and dust is a problem facing man from both industrial and domestic aspects and that certain steps have been taken to enable him to control all except dust from natural sources. The author feels that generally the basic principles of grit and dust extraction are well known and may be easily applied but the failure in the past seems to have been in the matter of application. The author feels that immediate research is required to find simple and cheap methods of grit and dust extraction to the benefit of employee and employer and the community as a whole.

High Efficiency Gas Cleaning by K. Darby (Lodge-Cottrell Ltd.)

In this paper some of the factors affecting the visibility of stack discharge and the rate of dispersion of dust are described. A review of various types of gas cleaning plants is given, together with important characteristics which determine their usefulness for different applications.

Some Problems of Dry Processes for Removing SO_2 from Flue Gases by J. Bettelheim (Research Fellow C.E.R.L.), B. H. M. Billinge (Group Leader, C.E.R.L.) and A. C. Collins (Head, Surface Chemistry Section, C.E.R.L.)

In view of the large scale of modern electricity generation, the authors feel that the problems of engineering and recovery process to produce elemental sulphur for commercial use are considerable. Capital costs would be high and material losses, as a result of rigorous chemical cycling for prolonged periods, present high running costs. In addition, the quality of the product is in considerable doubt because of possible contamination by these impurities. At present there is no process which appears commercially attractive for economic sulphur recovery and the enormous cost of removing sulphur dioxide could not be justified on the grounds of alleviating ground level pollution.

Electrostatic Precipitators by A. J. Moyes and M. Swift (W. C. Holmes and Company Ltd.)

The paper describes the construction of the electrostatic precipitator, the factors affecting its design and operation, and refers to some of the processes on which electrostatic precipitation is applied. The general capabilities of the device as a dust collector are discussed.

Session Four—Furnaces and Chimneys

Boiler Furnace Design Consideration for Dual Fuel Firing by H. B. Weston (National Industrial Fuel Efficiency Service)

The author mentions the historic background and then deals with the problem under the headings of furnace heat transfer considerations; importance of defining heat input rate; effect of change in furnace absorption; package W.T. Boilers; furnace heat liberation rates compared; furnace heat flux and finally future trends.

Modern Chimneys by Max Beaumont (F. E. Beaumont Ltd)

This paper deals with the importance of the current operational design of a chimney, stressing the need for adequate insulation and maximum gas velocity. It indicates examples of modern chimney design and new type of external finish. The paper concludes with an indication of experimental work at present being carried out which will reduce atmospheric pollution.

Progress in Automatic Control by R. P. Braby (Honeywell Ltd.)

This paper sets out to give a brief survey of some of the many advances which have been made over the years in the broad area of "Automatic Control". It does not attempt to go into the area of precise theoretical or practical detail, nor does it elaborate on the design and operation of controllers except where necessary or desirable in order to clarify the main subject matter. "Automatic Control" has been taken to mean "Automatic process control".

Full copies of the papers are available from the Society, price 40p each or £5 a set.

Second Anglo-Spanish-Netherlands Symposium on Environmental Acoustics

The Acoustics Group of the Institute of Physics in collaboration with the Spanish Acoustical Society, The Netherlands Acoustical Society, The Netherlands Audiological Society and the British Society of Audiology is organizing a second symposium on Environmental Acoustics to follow the successful one held in Spain in 1970. The Symposium will be held from 2-5 July, 1972, at Imperial College. The scientific sessions will commence on the morning of Monday, 3 July, and end at mid-day on Wednesday, 5 July. The main topics to be dealt with will be: Environmental sound and human response; Current acoustical research topics in Spain, the Netherlands and the United Kingdom; and Education and musical acoustics. Further details from: Meetings Officer, the Institute of Physics, 47 Belgrave Square, London SW1X 8QX.

LETTERS

The Editor,
Clean Air
Sir,

Mr. R. Newton is rightly concerned (Clean Air, Spring Issue) about the possible use of selected bituminous coal singles ("Housewarm") on unexempted appliances in Smoke Control Areas, but he cannot be aware of the action taken to prevent this happening.

From the very start the National Coal Board were concerned to ensure that "Housewarm" was used only on new coal-burning roomheaters (The Smoke Eaters) and equally that no unapproved fuels should be supplied for such use. These arrangements were therefore made:

(a) suitable bituminous coal singles are selected only after very careful testing and are nominated as "Housewarm" clearly to distinguish them from unsuitable singles;

(b) "Housewarm" is sold only in sealed sacks of paper or plastic printed with a distinctive design so that it can readily be identified by the public as the authorised fuel and, for example, by local authorities should they wish to check that it is being used on an exempted appliance. Under the "Housewarm" name the sack carries the words: "The only recommended fuel for coal-burning roomheaters" and lists the appliances. In future these words will be added: "This coal should not be used in any other appliances";

(c) only coal merchants with adequate stocking, screening and packaging are authorised to handle "Housewarm" and these merchants are fully aware that it is illegal to supply it in Smoke Control Areas other than for exempted domestic coal-burning appliances;

(d) the appliance manufacturers are ensuring that all Smoke Eaters despatched from the factories carry clearly displayed notices that only "Housewarm" sold in sealed sacks to the standard design must be used.

This action must surely indicate a very thorough appreciation of the possible dangers and an equal determination to ensure that problems do not arise. Genuine mistakes are unlikely to be made and the few who might deliberately try illegally to use "Housewarm" on unexempted appliances would be much more easily identified because of the distinctive sack.

I hope this reply satisfies Mr. Newton that his fears are groundless—the Smoke Eaters can contribute much to cleaner air, not only in the Smoke Control Areas but, because they are so cheap to run, in 'White Areas' as well, and this must surely be welcome.

Yours faithfully,
GEOFFREY KIRK,
Director of Public Relations

National Coal Board,
Hobart House,
Grosvenor Place,
London.

The Editor,
Clean Air
Sir,

Mr. John Mortimer, editor of the Engineer, is reported (Guardian, April 17th), as saying "big industrial concerns should make room on their boards for a new top man—the anti-pollution director". Reading the Annual Report of Sir Eric Drake, Chairman of British Petroleum, one might be excused for believing that the company have anticipated such an appointment since Sir Eric states "we have taken important steps to ensure that the environment suffers as little as possible from our operations".

In spite of many protests over the years we in the vicinity of the S. Wales factory at Barry still suffer from the nauseating odours of ethyl acrylate, Dowtherm and fatty acid residues, all part of the B.P. Chemicals plastics plant.

We are cooperating with the Public Interest Research Association (Observer, March 6th) to give evidence on the manner in which the Alkali Inspectorate (and local Authority) have failed to prevent factory waste from being discharged indiscriminately. Excessive noise from inadequately silenced machinery also contributes to spoilation of the environment. The contempt with which these complaints are dealt with makes Sir Eric Drake's statement farcical.

We know of other instances of pollution by B.P. and it would be interesting to hear from readers similarly afflicted.

Yours faithfully,
W. DOUTHWAITE,
Secretary

Residents Association,
Minehead Avenue,
Sully.

The Editor,
Clean Air
Sir,

It was with great interest that we read the article on "Designs with Air Pollution in Mind" in your Spring Issue, particularly since Jeffrey Ollswang, a former Assistant Professor of Architecture, chose a petroleum refinery as his example of a primary pollution source.

"To assure reasonable accuracy, and to establish a realistic context in which to carry out this study . . ." Mr. Ollswang sets out to calculate refinery pollutant emission values. Unfortunately the results of his calculations are, without exception, grossly in error. He has confused the feedstock throughput to individual units with the total refinery crude oil throughput. In a typical European refinery, feedstock to boilers and process heaters is equivalent to 5·9 per cent and that to catalytic crackers to about 5 per cent of total refinery crude oil throughput. In the table attached we quote emissions from such a refinery based on a correct interpretation of the emission factors quoted in reference (1) and compare these with Mr. Ollswang's erroneous data. The effect of his confusion in interpretation is patently obvious.

It is not clear from the article how a figure of 414 lb/1000 bbl refinery capacity has been arrived at for emissions from "miscellaneous process equipment". However, we estimate from reference (1) that the quoted figure is at least a factor of 3-4 too high.

We sympathise and agree with Mr. Ollswang's desire to control and abate pollution, but felt that we could not let his miscalculations pass without comment.

Finally let us assure your readers, if this be necessary, that we are constantly evaluating and working to minimise emissions arising from all our operations and their effects. We certainly do not "indiscriminately dump into the atmosphere"; concern for *our* environment is not exclusive to those outside the oil industry.

Yours faithfully,

S. L. HOBKINSON,
M. T. WESTAWAY,
L. R. BEYNON

BP Trading Ltd,
Poplar House,
Chertsey Road,
Sunbury-on-Thames.

Reference

(1) "Compilation of Air Pollutant Emission Factors", US Department of Health, Education and Welfare. Environmental Health Series AP PB 190245-1968.

Table 1

Process Source *Pollutant: Rate of Emission*	*Tons/Year* *Ollswang*	*Corrected*
(a) Boilers and Process Heaters		
Hydrocarbons: 140 lbs/1000 bbls oil burned.	2450	112—196
Nitrogen Dioxide: 2900 lbs/ 1000 bbls of oil burned.	50750	2312—4046
Formaldehyde: 25 lbs/ 1000 bbls of oil burned.	437·5	20—35
(b) Fluid Catalytic Units.		
Hydrocarbons: 220 lbs/ 1000 bbls of feed.	3850	189
Nitrogen Dioxide: 63 lbs/ 1000 bbls of fresh feed.	1102·5	54
Formaldehyde: 19 lbs/ 1000 bbls of fresh feed.	332·5	16·3
Carbon Monoxide: 13750 lbs/ 1000 bbls of fresh feed.	239,750	11774
Ammonia: 54 lbs/ 1000 bbls of fresh feed.	945	46
(c) Miscellaneous Process Equipment. Cooling towers, valves, pumps, seals etc.		
Hydrocarbons: 144 lbs/ 1000 bbls refinery capacity.	7245	1900*

* Calculated from emission factors in reference (1).

INTRODUCING NEW MEMBERS

Robinson Willey Ltd.

Robinson Willey Ltd manufacturers of a wide range of gas fires have recently become members of the Society. In their range they include Firegem S, Firegem Deluxe S, Super Firedance S+5 and FireJewel S. The North West Division of the Society have recently seen the works of Robinson Willey Ltd on a technical visit. Further information on this firm may be obtained through our Readers Enquiry Service.

Reader Enquiry Service No. **7242**

British Acheson Electrodes Ltd.

British Acheson Electrodes Ltd, of Sheffield, who recently joined the Society, are one of the major suppliers in the United Kingdom of carbon and graphite shapes for the steel, chemical, nuclear and electrical industries.

Reader Enquiry Service No. **7243**

Individual members.

B. W. Imrie.

D. C. Roots.

A. J. Lemos Salta (Portugal).

O. B. Silver.

W. Barnes.

IUAPPA

Third International Clean Air Congress

Call for papers

The 3rd International Clean Air Congress will be held at the Congress Centre, Neue Messe, Dusseldorf, West Germany, from the **27th-31st August, 1973.**

The Chairman of the International Programme Committee has asked for the submission of papers to be presented at this Congress. Abstracts of proposed papers, which should not exceed 200 words, from British authors are required to reach the Director of the National Society for Clean Air by **30th June, 1972.** Subjects to be covered are:

1 **Principal Subjects**

1.1 Means and technical methods for the reduction of air pollution in heavily polluted regions.

1.2 Ways of controlling air pollution in new plants (including design of technical and administrative regulations).

1.3 Clean air through new technologies (pollution-free plants, harmless raw materials and products).

1.4 Education and training; public relations.

2 **Profile Subjects**

2.1 Influence of meteorological factors on air pollution.

2.2 Physics and chemistry of atmospheric pollutants.

2.3.1. Criteria for the determination of the effects of air pollution (effects of health, animals, vegetation and materials).

2.3.2. Air quality criteria and standards.

2.4 New systems of measurements (emission and environment).

2.5 State of differing national legislation: the technical and economic consequences resulting therefrom.

2.6 Role of fiscal policies and taxation in fighting air pollution.

2.7 Clean air through regional and urban planning.

3 **Branch Subjects**

3.1 Combustion for domestic heating and industries.

3.2 Combustion in power stations.

3.3 Air pollution from road vehicles and aircraft.

3.4 Mining (including processing, e.g. coking plants, briquette factories).

3.5 Cement, lime, brick and ceramic industries and building techniques.

3.6 Iron and steel industry, non-ferrous metal smelters, re-melting works, foundries.

3.7 Chemical industry.

3.8 Petrochemical industry, refineries.

3.9 Agriculture and animal husbandry.

3.10 Waste disposal and recovery.

Further details and application forms may be obtained from the Director, National Society for Clean Air, 134/137 North Street, Brighton BN1 1RG.

Full information about the Congress will be promulgated in future issues of this journal.

39th Annual Clean Air Conference, Scarborough

16th - 20th October, 1972

PROGRAMME

OPENING SESSION—MONDAY 16th OCTOBER

The Conference will be opened by Lord Kearton, O.B.E., F.R.S.
The President, Stanley E. Cohen, Esq., C.B.E., will deliver the Presidential Address.

SESSION TWO—TUESDAY 17th OCTOBER

"POLLUTION CONTROL—HOW FAR CAN WE GO?"
Dr. C. J. Stairmand (*Consultant, formerly of I.C.I. Ltd*).

OPEN SESSION—TUESDAY 17th OCTOBER

Clean Air Quiz for Teams from Local Schools.
Session open to general public, local organisations, schools and colleges.

SESSION FOUR—WEDNESDAY 18th OCTOBER

"METALS IN THE ATMOSPHERE"
(*Scientific Adviser to the Greater London Council*)

SESSION FIVE—THURSDAY 19th OCTOBER

"THE SCHEDULED PROCESSES"
F. E. Ireland (*H.M. Chief Alkali and Clean Air Inspector*).
"AIR POLLUTION AND THE CHEMICAL INDUSTRY"
F. Whiteley (*I.C.I. Ltd*).

SESSION SIX—THURSDAY 19th OCTOBER

"ODOUR NUISANCES IN INDUSTRY"
A. I. Biggs (*Confederation of British Industry*).
"ODOUR NUISANCES IN AGRICULTURE"
Dr. F. H. Peakin (*Dept. of Food Science, University of Reading*).

SESSION SEVEN—FRIDAY 20th OCTOBER

"EFFECTS OF AIR POLLUTION ON VEGETATION AND PLANT LIFE"
Dr. L. H. A. Jones and D. W. Cowling (*The Grassland Research Institute*).

Further information and the conference brochure may be obtained from the Society.

INDUSTRIAL NEWS

SOLID AIR POLLUTION

by E. E. Michaelis, C.Eng. M.I.Mech.E.
(Director of Pearson Panke Ltd., Agents for SICK OPTIK-ELEKTRONIK Smoke and Dust Density Measuring Instruments)

The success of clean air legislation in reducing smog in many parts of Britain is evident to anyone with a memory which goes back more than a few years. In spite of this, concern about pollution of the environment is on the increase rather than on the decrease. This concern is made up of many factors such as an increased understanding of the poisonous nature of many pollutants, the dwindling amount of open space resulting in a greater need to conserve what is left of the countryside and the well justified demand for improved living and working conditions within our cities.

This article is concerned with the pollution of the environment caused by solid matter emitted from chimneys and other forms of exhaust ducts on industrial installations, such as power stations, cement works, etc., which often cover the surrounding countryside in layers of particles of the pollutant. The link between the emission of smoke or dust particles from such installations and the effect of this in obscuring light is an obvious one in general terms. Efforts to limit the unpleasant effects of such installations therefore attempted, first of all, to relate particularly smoke emission to light obscuration. In the 1956 Clean Air Act these effects were related to the Ringelmann chart, with which simply the darkening effect of smoke is compared to a kind of colour chart system. That this approach was of great benefit is clear from the improvement in the smoke situation since that time, but with heavy industrial plant the emission from chimneys and similar ducts remains a very serious problem, and it has long been concluded that the Ringelmann chart technique is inadequate for such installations. From the point of view of the pollution of the environment, and incidentally also loss of product in many instances, the real concern is with the weight of solid matter which is spread around or lost, in other words, the density of smoke or dust which is being emitted at any given time or over a defined period. Thus the measurement of smoke and dust density has become a matter of major concern, and a matter of law in the Autumn of last year.

To measure this at a given instance in time, techniques have been devised to collect a measured volume or weight of air or gas and to filter out the solid matter, and then to weigh this. This technique now reaches quite high degrees of accuracy, but as a means of limiting pollution (or loss of product) it is unsatisfactory because samples have to be taken almost continuously in view of the varying rate of smoke or dust emission on most kinds of plants.

Fortunately, another solution is possible as there is a mathematical relationship between the loss of light, expressed in the form of the ratio of light intensities and the smoke density in terms of weight per unit volume or weight of gas and air, provided one can assume that various parameters such as the grain size and the distance over which the measurement is made remain constant. The relationship is a logarithmic one. A photo-electric instrument can therefore be built with an output scale of logarithmic form to give direct reading of smoke density for a given set of conditions. Such photo-electric measuring instruments were introduced many years ago. In 1969 the British Standard No. 2811 was issued which sets out the basic requirements for such equipment and indicates clearly the problems which are inherent in this approach, namely that such an instrument in its basic form cannot distinguish between dirt on its optical surfaces and the effect of the obscuration caused by the smoke. The Standard therefore lays down that the instruments should be installed in such a way that the surfaces in question can be cleaned "at least once per shift". Unfortunately, this requirement is at odds with the desirability to mount the equipment at a point where a light beam through the chimney or duct will pass through an average sample. The distribution of the smoke across the cross-section of the chimney becomes more uniform at points higher up in the chimney, i.e. it tends to be irregular nearer the bottom end. Clearly it is advisable to try to devise a method of avoiding this need for very frequent cleaning. Furthermore, the accuracy of the instrument in terms of measurement of light obscuration must be high if after conversion to a log scale any errors are not to be exaggerated beyond reasonable limits over a part of the range.

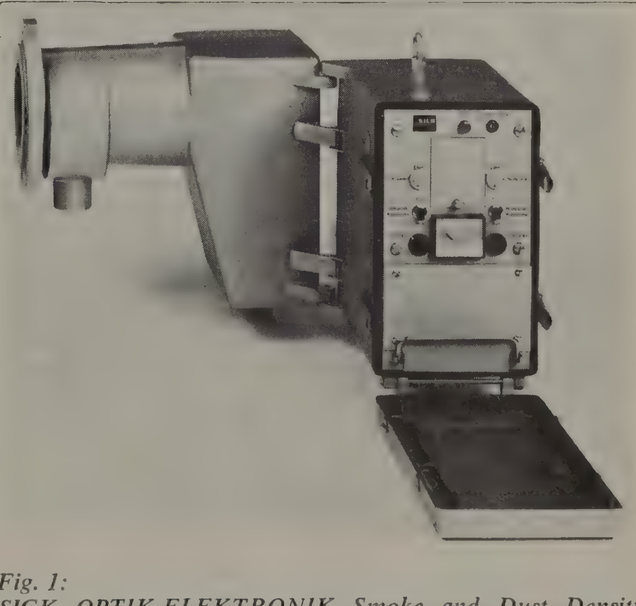


Fig. 1:
SICK OPTIK-ELEKTRONIK Smoke and Dust Density Measuring Instrument—partially opened.

Long before the introduction of the British Standard, Sick Optik-Elektronik of Munich, studied these problems and as a result of the considerations the instrument shown in Fig. 1 was devised.

Fig. 1 shows the optical head. The flange, which is bolted to the chimney, is shown on the left. The air connection for the air flushing attachment referred to further below, can be seen just below the flange. The optical and electronic section is hinged on the front chamber and is shown swung round at right angles, with the hinged back cover swung downwards.

Fig 2:
SICK OPTIK-ELEKTRONIK Smoke and Dust Density Measuring Instrument showing exposed optical system.

Fig. 2 shows the opened up optical system mounted on stands for demonstration purposes. The air flushing system is not shown in this photograph.

Fig. 3 is a diagram of the optical system.

Two beams of light are taken from the light source (light bulb) shown on the left. These beams of light pass through identical systems of lenses and they reach a rotating disc with two rows of different numbers of holes causing the light to be modulated to different frequencies. Both light beams then pass through special semi-transparent mirrors. The light beam shown at the top of the diagram crosses the chimney and reaches the reflector on the other side, which throws it back on itself so that it crosses the chimney a second time and, after coming back to the semi-transparent mirror, it is thrown on to the photo-sensitive device. The second light beam (shown at the bottom of the diagram) reaches a reflector which is on the same side of the chimney as the light source and is returned from this reflector, in a similar way to the first beam, to the photo-sensitive device.

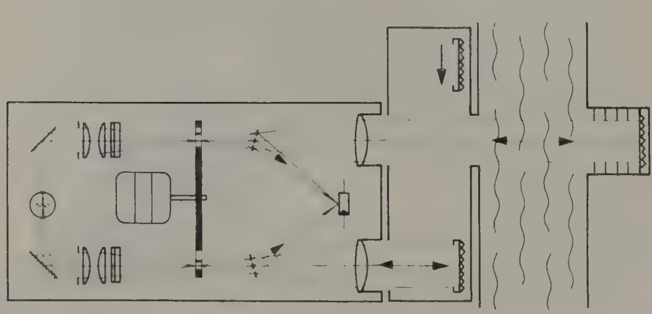


Fig 3:
Optical diagram of SICK OPTIK-ELEKTRONIK Smoke and Dust Density Measuring Instrument.

The reflector system uses the same optical principle as that employed for "cats' eyes" (or as set up on the moon for laser measurements) which has the advantage that the arrangement is not sensitive to accurate alignment, including minor distortions of the chimney. The fact that the light passes through the chimney twice means that with the low smoke densities which are permitted the effect which is being measured will be doubled.

We thus receive at the photo-sensitive device two light beams of different frequency, whose intensity will differ depending on the density of the smoke, since only one has crossed the chimney. The light source and the light receiver used for both paths is the same so that ageing of the light bulb, voltage variations and any changes in the properties of the photo-sensitive device will effect both paths equally.

Furthermore, to the extent to which one can assume that the tendency of dirt to settling on the various optical surfaces will be identical along the two paths, the effect of this will also be the same on both signals. Fig. 4 shows the principle of the electrical evaluating circuit. The electrical signal from the photo-sensitive device is amplified, filtered to the two different channels corresponding to the two different frequencies, amplified further and then rectified. The signal from the comparison beam is fed back to the initial amplifier as a regulating signal. The initial amplifier acts as a regulating amplifier to keep the comparison signal constant and so cancels out the variables referred to earlier, which would otherwise cause inaccuracies. The measuring signal passes on to a logarithmic conversion circuit so that an output signal is obtained which is proportional to the smoke density, and the instrument can be given a linear callibration scale to suit the parameters of the particular installation.

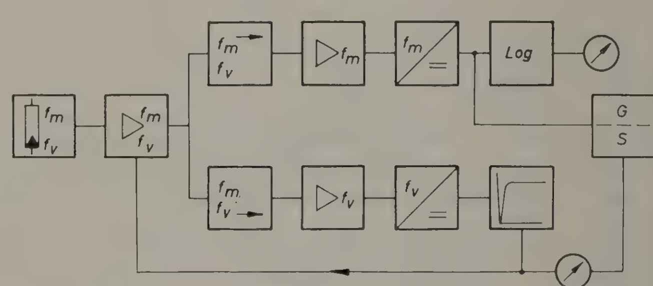


Fig 4:
Block diagram of Electronic System of SICK OPTIK-ELEKTRONIK Smoke and Dust Density Measuring Instrument.

Steps are taken to keep the optical surfaces clean by the application of cleaning air in intermediate chambers between the optical equipment and the chimney, arranged so that there is always a flow of air from these chambers into the chimney which will be sufficient to prevent flow of dirt in the opposite direction, but not strong enough to blow away the smoke. The air flow arrangement is basically similar to that suggested in B.S. 2811. (Fig. 5 shows how the Sick instrument can meet the requirements of this standard, and go well beyond, especially in regard to maintenance of the equipment—every six months compared with every day.)

B.S. 2811 : 1969 requirements/SICK Measuring Equipment

B.S. 2811 : 69 Reference	*RM4 Equipment*
Para. 1.3 (1) Flue mounted components	Yes
(2) Control equipment	Yes
(3) Indicating meter calibrated in % obscuration, optical density or both	Calibrated in optical density
(4) A recorder calibrated as (3)	Yes
(5) Alarm actuating device, integral	Can be fitted
Para. 2.1 Light beam length 0·3 m up to 6 m	Up to 10 m
2.2 Flow of air into flue minimal	Yes
2.3 Length of cable between units up to 30 m	Up to 2·5 Km possible
2.4 Protection of units, dust and weatherproof	Yes
2.5 Cleaning and servicing. Easy access in situ	All equipment has easy access and lense units only require cleaning at 6 monthly intervals
2.6 Electrical safety	Yes
2.7 Wiring requirements	Yes
2.8 Connections for alarms and recorders	Provided
2.9 Accuracy, 3 bench standards required on test	Built in zero point and one scale point standard reference filter for check at any interval of time
2.10 Instrument stability. Meet 2.9 after one week	Yes—up to 6 months
2.11 Ranging. Possible to set zero point and full range	Zero point setting plus one scale point calibration
2.12 Supply voltage. Var. I 10% will not cause more than 5% scale error	Nominal voltage for stable operation of equipment to 3% accuracy is 220/240 V I 10%
2.13 Temperature stability up to max. ambient temperature of 45%	Operational range for stable indication −30°C to +60°C
2.14 Markings on equipment	Can be arranged

Fig 5: Table to compare the SICK OPTIK-ELEKTRONIK instrument with B.S. 2811.

For additional security against inaccuracies a number of steps are taken. If the feedback voltage from the comparison path increases beyond permissible limits a warning is obtained. To keep a check on the correct reading of the instrument for zero obscuration a third reflector is provided, mounted on a turning magnet mechanism. This reflector, which is represented diagrammatically at the top of Fig. 1, in the optical head close to the chimney, is swung into position automatically under the control of a time switch. The resulting reading is recorded on the graphical recorder referred to further below and if it is not within laid down tolerances for zero obscuration, again a warning is obtained. To ensure that the accuracy is also maintained along the scale, a calibrating filter is similarly swung into the light path automatically at regular intervals. Monochromatic light is used to make the instrument insensitive to the colour of the particles.

The SICK Smoke Density Measuring Instrument with its automatic feedback correction system and its other features has been found capable of maintaining its accuracy to within 1 per cent of full scale deflection, although the manufacturer only quotes an accuracy of 3 per cent, without it being necessary to clean the instrument at intervals of less than six months.

The principal technical data is as follows:

Optical density (extinction)	0-2·0
	0-2·9
	0-0·45
	0-0·09
Distance of scan, depending on type of reflector used, up to	a) 5 m
	b) 10 m
Output signal (in addition to adjustable threshold value relay with normally open contact) to suit graphical recorder or other equipment with max. internal resistance of 300 ohms	0-20 mA, 7·5 V
Permissible ambient temperature	−30° to +60°C
Max. length of cable from optical head to control room	2·5 km

In the past these installations (which have for example been compulsory on appropriate plants in the North Rhine/Westphalia area of Western Germany for many years) have been equipped with graphical recorders for smoke density against time, and with limiting value switches to give warning when the rate of emission exceeded prescribed limits. The drawback of such an arrangement on its own is that it is still necessary to assess and evaluate the diagrams from the graphical recorder, and furthermore, this system lends itself to a certain amount of abuse especially if, as is the case in the area of Germany referred to, there is a system of financial incentive for establishments which limit the pollution which they produce. Recently, therefore, an integrator was introduced which can be coupled to the instrument and which is installed as a partially sealed unit to integrate electrically over a time period of up to nine minutes, up to fifteen minutes, and up to six hours (in three separate sections), the amount of solid matter emitted, giving warning when this approaches limiting values and shutting the installation off automatically when the limits are exceeded. The instrument has appropriate arrangements for pre-selection.

It will be appreciated that an instrument used in the manner described above must be of proven accuracy and indeed the German Authorities concerned conducted exhaustive tests before the design was approved for this application.

The Clean Air (Measurement of Grit and Dust from Furnaces) Regulations 1971 (No. 161 and 162) lay down limits of smoke emission for certain types of installation. Automatic monitoring can ensure that malfunctioning in an installation will not cause the law to be broken inadvertently and thus help to safeguard the operator of an installation from arguments with the local authority. To protect the operator against a possibly very costly unnecessary shut-down, it is of vital importance not only to be able to stop the equipment when the legal limits of smoke emission are exceeded but to have early warning when this condition is approached so that preventative steps can be taken.

It seems to the Writer that only by continuous accurate assessment of the emission of pollutants can substantial further progress be made towards reducing solid air pollution, and a resulting contamination of the countryside and urban areas around our industries.

Reader Enquiry Service No. **7245**

Overcoming Health Hazards of Asbestos Cascade Takes Regulations as Minimum

It is paradoxical that asbestos which has long been established internationally as an insulant should have been recognised only comparatively recently as a potential "killer". In this country, The Asbestos Regulations 1969, which came into operation in May 1970, lay down stringent rules covering the precautions which need to be taken for the protection of every worker likely to come into contact with the harmful asbestos dust.

One major insulation contractor has now taken these Regulations as a minimum precaution and spent several thousands of pounds on buying special caravans, to give its employees specialised protective and changing facilities on each contract site.

The company, Cascade Insulation Services Ltd, part of the special products division of the Aberdare group, is an approved contractor for insulation work for the Central Electricity Generating Board and for the Ministry of Defence, as well as being active in the supply and application of all forms of insulation in the oil and petro-chemical, gas, furnace and boiler construction industries.

Many of the contracts in which the company is involved entail removing existing asbestos insulation and re-insulating with Ceramospray, a completely asbestos-free ceramic fibre material. This type of work is also expected to increase dramatically into other fields now that Ceramospray has been awarded a fire certificate by the Joint Fire Research Organisation which means that it can now be marketed as a fire-protection for all types of buildings and offices.

Each caravan has "clean" and "dirty" areas. The workers remove their outdoor clothes in the clean area and pass through an air lock into the dirty section where they put on special nylon overalls and rubber gloves. Approved respirators are tested and worn by each man to exclude fine and toxic dusts.

Inside the power station, the area to be de-lagged is surrounded by a tent of polythene sheeting, the interior of which is continually exhaust-ventilated by an extractor fan. The actual stripping of asbestos is carried out within this fully enclosed area. As the laggers leave the tent, an industrial vacuum cleaner is used to remove all traces of asbestos dust from clothing.

At the end of the shift the men enter the dirty area of the caravan and remove their overalls which are stored separately for cleaning. After a shower, they pass through the air lock into the clean area where their outdoor clothing is stored.

When the asbestos is finally removed, and the area is completely clear of all harmful dust, the caravan is towed away to the next contract, while the new and non-toxic Ceramospray insulant is applied by special gun.

Reader Enquiry Service No. **7246**

30 Per Cent Growth for Gas

The growing popularity of natural gas as a fuel in homes, industry and commerce is underlined by figures, released by the Gas Council, which show that the gas industry increased its output by a massive 30 per cent during the year 1971-72.

In the year, Britain's natural gas industry raised its output to a record 8,674 million therms—29·6 per cent more than in the previous year.

This unprecedented increase is due to the increasing availability of natural gas from North Sea discoveries which has been carefully matched by the industry's marketing programme.

It was only in the mid-1960s that the Gas Council forecast a fourfold increase in gas sales—from 1,000 million cubic feet a day to 4,000 million cubic feet a day during a 10-year period. The newly announced figures show that the gas industry is right on target.

Natural Gas Conversion 1972/73 Programme

By the end of the year ending 31 March, 1973, well over half of Britain's 13·5 million gas customers will have been converted to North Sea natural gas.

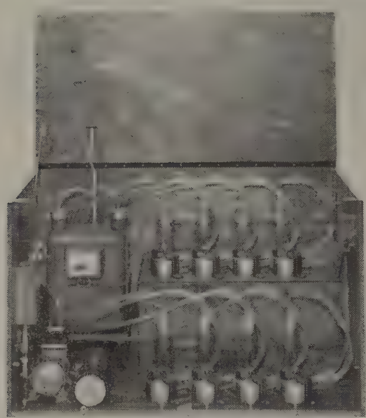
In the programme up to 31 March, 1972, 5,986,000 industrial, commercial and domestic customers had been converted to the new gas. In the next 12 montths it is planned that a further 2,326,000 will be converted to bring the total to 8,312,000—62 per cent of all customers.

During the 12 months to 31 March, 1972, 2,362,000 customers were converted. The conversion of all customers is scheduled to be complete by March, 1977.

Reader Enquiry Service No. **7247**

Glass Developments Air Pollution Monitor now in Production

The EP/ILAC/101 air pollution monitor, based on the original design of the Ministry of Technology's Warren Spring Laboratory, is now in full production at Glass Development Limited.



This instrument measures throughout successive 24 hour intervals the concentrations of Smoke and Sulphur dioxide in the atmosphere. The basic principle of operation is that a known volume of air is drawn into the instrument, passed through filter paper and then aspirated through a standard solution of Hydrogen peroxide.

Smoke particles are retained by the filter paper and the equivalent mass concentration is calculated from a standard smoke calibration curve after measurement of the darkness of the stain with a reflectometer.

The concentration of Sulphur dioxide is estimated by measuring the acidity of the Hydrogen peroxide solution by Titration with a standard alkalai.

The Air Intake is switched sequentially each day to a different filter paper and solution and this means that up to seven consecutive daily measurements can be made with only one visit to the instrument each week.

EP/ILAC/101 is the instrument which is used at the majority of sites in the United Kingdom in the National Survey of Air Pollution.

Reader Enquiry Service No. **7249**

Desulphurizing Residual Oils

There is an increasing demand for low sulphur residual fuel oils. Because supplies of low sulphur crudes are limited, an effective method is needed for desulphurizing residual oils derived from crude with high sulphur contents.

Desulphurization of gasoline and middle distillates has been standard practice at many refineries for over 10 years but desulphurization of residual oils is much more difficult because they contain asphaltenes and certain metals such as vanadium and nickel which impair the activity of the catalyst. They also contain particulate matter that may plug the catalyst bed.

Following extensive research and development work at the Amsterdam laboratory the first Shell commercial scale plant for desulphurizing residual oil is being erected at the Shell Koppertrans refinery in Sweden at an estimated cost of £3·5 million. It will have the capacity to desulphurize 400 tons of residual oil per day.

In the new unit residual oil and hydrogen compressed to a pressure between 200 atmospheres are heated to approximately 400° C. The mixture is then passed over a special catalyst in two reactors coupled in series where the sulphur is removed from the organic sulphur compounds in the residual oil. The sulphur combines with the hydrogen to form hydrogen sulphide that is led to a sulphur recovery plant where it is oxidized with air to form elemental sulphur. Depending on the sulphur content of the residue feed, some 5 to 10 tons of sulphur are produced every 24 hours.

Massive Smoke Control Programme in North East

One of the most comprehensive smoke control programmes to be carried out in the North East of England is now almost completed. Eighty-five percent of all local authority properties in Hebburn Urban District Council have now been converted to smoke control.

At the same time as this massive smoke control programme, an extremely ambitious modernisation scheme is also being carried out. Spearhead of both programmes is to eventually install full central heating in all local authority properties in Hebburn.

The new Parkray 88Q solid fuel central heating unit by Radiation Parkray Limited is specified by Hebburn for inclusion in both the smoke control properties and the modernised houses. Tenants are offered a choice of the Parkray 88Q or a gas-fired system, and so far approximately 75 per cent have plumped for solid fuel heating by Parkray.

A Moving Solution

Nailsea Engineering of Blackburn, the British specialists in industrial dust extraction, have produced a novel solution to a tricky problem.

One of the firm's specialities is equipment for the extraction of dust from road-stone materials used in making asphalt—usually by its very nature rather massive and immobile plant. In Motorway building, however, there is an increasing tendency to use the hot laying method, which necessitates the asphalt being made as close to the working site as possible.

Given this problem by a Swedish client, Nailsea came up with a complete mobile unit mounted on a trailer and capable of travelling over all roads at normal traffic speeds. Chief difficulty to overcome was the fact that the equipment normally required deep hoppers for finally getting rid of the waste matter. This was solved by the ingenious use of air-beds to "fluidise" the dust particles, so that they flowed easily down a shallow gradient to the disposal unit. As a result, Nailsea's mobile unit occupies very little more space than a normal furniture van, but is capable of extracting 7½ tons of dust per hour.

Five mobile units have now been delivered and are fully operative in Sweden.

Reader Enquiry Service No. **7250**

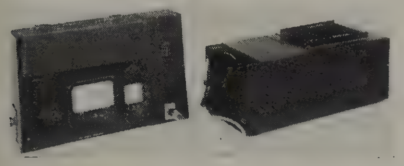
Increased Sales of Appliances by Electricity Board Shops

There were substantial increases in sales of many electrical appliances by Electricity Board shops in the quarter ended December 1971. Compared with the similar period of 1970, sales of washing machines went up by 51·2 per cent; vacuum cleaners by 53·5 per cent; refrigerators by 19·4 per cent; food freezers by 68·9 per cent and clothes dryers by 7·4 per cent.

Storage radiator sales increased during the quarter by 7·4 per cent, although the year's comparison showed them to be down by 7 per cent. Recently, however, there have been indications that a greater percentage of storage radiators are being sold through private contractors.

Optical Dust Monitor

Immediate and continuous note of air pollution level is possible with this new electro-optical instrument. The dusts measured include sizes in the range of health hazard, and larger particles.



Dust concentration in air is monitored, particles being counted one by one, both total count in unit time, and rate of count is shown via digital and meter display. Over the range, 2-loo micron, a good approximation to particle size is obtained. Smoke, and vapour levels are shown on a separate meter. A measure in terms of numbers of particles per cubic ft. as well as relative or changing dustiness is possible. Numerous existing dust sampling methods are superceded in terms of accuracy, or immediacy, and the time element.

The instrument can be rented or purchased.

Reader Enquiry Service No. **7251**

£39,000 Order for Mikropul Dust Collectors

Dust extraction equipment worth £39,000 has been ordered by Peglers Ltd. for use in connection with an open hearth brass smelting plant at the company's Belmont Works in Doncaster, Yorkshire.

The equipment chosen by Peglers is the Top Removal Mikro-Pulsaire manufactured by Mikropul Ltd. of Towerfield Industrial Estate, Shoeburyness, Essex.

Five Mikro-Pulsaires will be manifolded to two open hearth furnaces so that any one of the five units may be isolated for routine maintenance without interrupting production.

Export and Home Orders for R.H.F.'s Anti-Pollution Units

Two orders totalling over £60,000 won by the Environmental Systems Division of Redman Heenan Froude, the Worcester-based member of the Redman Heenan International group of companies, for its filter units highlight the growing world-wide awareness of the need to reduce atmospheric pollution. The orders cover an Aeropur filter and special incinerator for the Burgh of Clydebank, and an Aeropur filter for Hoffman la Roche of Basle, Switzerland.

The Redman Heenan Aeropur filter, which has been developed for the purification of flue gases, operates by electrostatic precipitation. It consists basically of a steel tower in which the gases are directed upwards over a series of electrodes maintained at a high negative voltage. Suspended particles in the gas are ionized and, as a result, are attracted to the positively-charged wall of the tower, continuous irrigation of the walls washing the particles to a settling tank. Efficiencies of over 99 per cent removal of particles down to sub-micron size have been achieved and in addition to this function, the filter reduces the emission of harmful gases such as sulphur dioxide. Use of an Aeropur filter gives an added advantage in that it obviates the need for a chimney.

The Clydebank installation will be used for the burning of industrial waste, a large proportion of which will comprise rubber and plastic scrap. The incinerator will have a capacity of 500 kg per hour and will be of the new hearthless type; a design particularly suitable for dealing with this type of waste.

The Aeropur filter for Hoffman la Roche, one of the largest manufacturers of pharmaceuticals in the world, will be installed within the existing incinerator-boiler complex which deals with the waste from the entire factory, including chemicals. Similar to the Clydebank installation, it will also treat 16,000 cubic metres of flue gases per hour and will drastically reduce pollution of the atmosphere.

Industrial Waste Assessment by Harwell Scientists

Harwell has been commissioned to begin a pilot study into the scale and nature of current industrial waste in the upper Mersey valley. It will include an evaluation of the problems which arise from the present methods of disposal and will investigate the impact of new industries. Recommendations will be made as to what action will need to be taken to control and reduce environmental pollution in the area.

The contract has been placed by Cheshire County Council, Lancashire County Council, Runcorn New Town Development Corporation, Warrington New Town and Warrington County Borough in collaboration with local industry.

In addition to assessment of the waste problem in the upper Mersey valley, Harwell has also been retained by Cheshire County Council to investigate the chemical content of a major industrial waste tip at Sandbach which it is intended to reclaim.

CLEAN AIR

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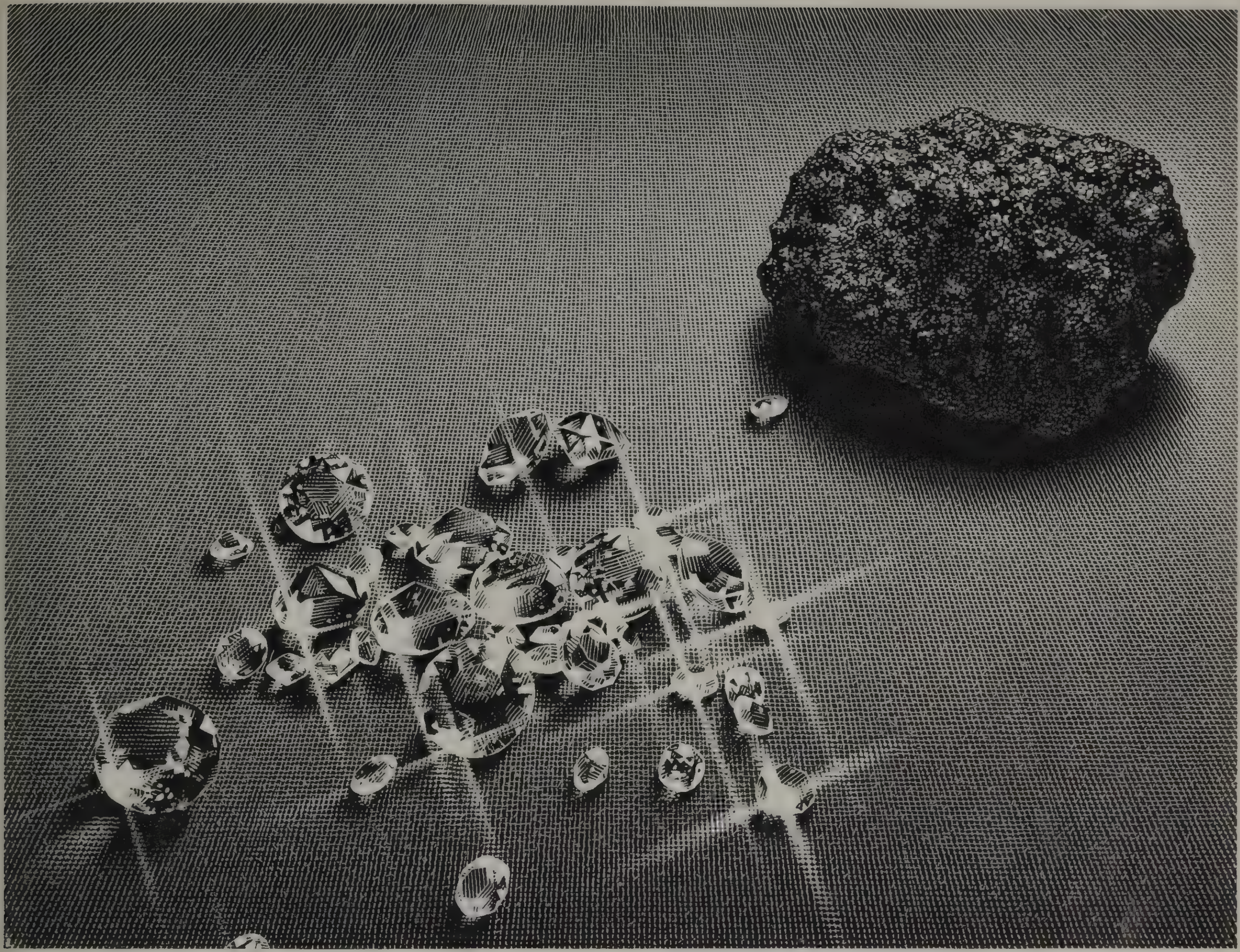

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CLEAN AIR

incorporating "Smokeless Air"

AUTUMN 1972
VOL. 2 NO. 7

PRINCIPAL CONTENTS

PRICE 30p

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

Vol. 2 No. 7 Autumn 1972

Principal Contents

Index to Advertisers

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Reader Enquiry Service No. 7258

"This most excellent canopy, the air"

CLEAN AIR

Control of Vehicle Exhaust Pollution—at last

The Department of the Environment is consulting interested organisations, amongst them the Society, on a proposal that by October 1973 most new petrol engined vehicles will have to comply with the limits for the emission of carbon monoxide and hydrocrabons laid down by ECE Regulation No. 15. This new regulation, if brought into force, will apply to petrol engined vehicles first used on or after the 1st October 1973 and not manufactured before the 1st April 1973. That is to say the regulation will apply to new cars and not to those already on the road. Compliance with the new regulation say the Department of the Environment "will reduce emissions of carbon monoxide by up to 30% and of hydrocarbons by up to 10% as compared with the emissions from an uncontrolled vehicle." This will be achieved by the careful adjustment of the carburettor and timing devices.

The actual tests prescribed by ECE Regulation 15, which is dated the 11th March 1970, require that the car shall be tested for verification of the average emission of pollutants in a congested urban area after a cold start. This will require the vehicle being placed on a dynamometer bench equipped with brake and fly-wheel. A test lasting a total of 13 minutes and comprising four cycles will have to be carried out without interruption. Each cycle will comprise 15 phases (idling, acceleration, steady speed, deceleration etc.). During the test the exhaust gases will be collected and analysed and their volume measured. The mass of the carbon monoxide and the mass of hydrocarbons obtained in the test have to comply with a table laid down for vehicles of a certain reference weight. The second test that will have to be carried out on the new vehicle will be that for the measurement of carbon monoxide emitted at idling speed. The carbon monoxide content by volume of the exhaust gases emitted with the engine idling must not exceed 4.5%. ECE Regulation No. 15 also prescribes a third test which is concerned with provisions for reducing emissions of hydrocrabons by a further 25%. This requires the fitting of a device to prevent gases escaping from the crankcase. This, of course, has been mandatory on new vehicles registered in this country since the 1st January this year.

The Society naturally welcomes the proposal that such regulations should be applied. Actually the requirements are very limited and there should be very little difficulty in all new cars reaching this standard. Indeed tests already carried out by the Society up and down the country have shown that a considerable number of cars, some of them 10 years old, can reach these standards with a properly tuned and well maintained engine.

We should like to have seen these proposals for more stringent regulations, especially as the proposed regulations will apply to new cars only and as yet there is no provision for further tests being carried out once cars have left the factory. On discussing this aspect with representatives of the Department of the Environment, however, we were assured that arrangements for retesting at regular intervals will be introduced shortly; we understand that this is dependent to some extent with the proposals for more stringent MOT tests being carried out at a smaller number of depots. We were also assured that regulations for controlling emissions of hydrocarbons and the oxides of nitrogen will also be introduced in due course.

The Society certainly hopes that this will be the case; we have never advocated the rather savage legislation such as is prevalent in the United States, but we sincerely hope that once a start has been made on legislation to control emissions from the motor car, this will be steadily advanced until a reasonable level of control has been established.

Lead

There is much conflicting evidence about lead in the atmosphere and indeed much conflict in the way that this evidence is interpreted. Nevertheless although the present levels of lead emissions may not constitute a danger to health undoubtedly it is desirable that they should not be exceeded and if possible they should be reduced.

We therefore welcome the recent announcement, made by Mr. Peter Walker the Secretary of State for the Environment, of a phased programme to reduce the lead content of petrol. The maximum permitted level will be cut by almost one half over the next three years. The present permitted maximum is 0.84 grammes per litre. The intention is that the permitted maximum shall be reduced to 0.64 grammes per litre by the end of this year; to 0.55 grammes per litre by the end of 1973 and to 0.45 grammes per litre by the end of 1975.

This is indeed a step in the right direction and it is to be hoped that the reduction of lead content to 0.45 grammes per litre by 1975 will ensure that lead emissions from petrol engined vehicles will fall even when the rising number of vehicles on our roads is taken into account. We understand that the Department of the Environment is collaborating with the Department of Trade and Industry and the oil and motor industries in studying other means of controlling emissions of lead from vehicles to see whether further reductions are possible in the longer term. It is to be hoped that this study will prove successful and that further reductions will be made in the not too distant future.

The Annual General Meeting

Dr Barrett and Mr. Cohen at the Annual Luncheon

The Society's Annual General Meeting was held on Friday, 2nd June at the Connaught Rooms, Great Queen Street, London. Once again were we fortunate in the weather and the meeting was held on a glorious summer day. The attendance was good and many members spoke from the floor during the course of the business meeting. The Annual Report and Accounts were accepted and the New Honourary Treasurer, Dr. W. C. Turner, was in the happy position of being able to tell members that the recent financial trend had been reversed and that the Society had had a good year financially. Similarly the Chairman was able to report that the Society had enjoyed a very full and active year.

The Annual Public Meeting followed the business meeting. This was very well attended indeed. The address was given by Dr. J. W. Barrett, C.B.E. of Monsanto Chemicals; his address is reproduced in full later in this journal. The Society are indeed indebted to Dr. Barrett for giving such a stimulating address which provided everyone who was fortunate enough to hear it with much food for thought. Dr. Barrett very kindly stepped in to the breach when it was learned shortly before the meeting that Mr. Peter Walker, M.P., the Secretary of State for the Environment who had originally agreed to address the meeting would be unable to do so.

The Annual Luncheon held after the Public Meeting was a very happy occasion at which all those present thoroughly enjoyed themselves. The two speakers, our President, Mr. Stanley E. Cohen and Dr. Barrett who replied to the toast of the guests, both showed that they were accomplished after luncheon speakers.

POLLUTION AND ALL THAT

by

C. J. O. Moorhouse

Report on The United Nations Conference on the Human Environment, Stockholm.

This article is published in Clean Air by the kind permission of the International Road Federation

Summary

A Conference of high endeavour which served to give meaning to its slogan "Only One Earth", exploring the problems of the human environment in the very broadest sense. Running as a dominant thread throughout the two-week dialogue was a clash in outlook between the rich and the majority; but towards the end there emerged the beginnings of a common understanding of each other's problems which may well have a highly significant bearing on the future setting of environmental standards. Industry as such never seriously became a target for attack, being literally dwarfed by the magnitude of the political and environmental issues that found expression in the Conference. An encouraging feature of the Conference was the clear recognition of the need for wide ranging scientific research on the many problems of the human environment, to which end some 120 action proposals were approved. Those with a major bearing on industry are listed in the attached.

Stockholm, Pollution and All That

So ran the headline of the leader in *The Washington Post* about the United Nations Conference on The Human Environment held in Stockholm from the 5-16 June, 1972. Certainly, there were few bounds to the subject matter of the debates in the Plenary Sessions and the Working Committees (Appendix 1). The meeting halls echoed with phrases like "ecocide in Viet Nam", "scientific imperialism", "the pollution of poverty", "environmental double-dealing", "plastic politics". Dominating the general scene from the beginning was the not unexpected clash between the rich and the poor, or the rich and the majority as Barbara Ward*, who holds the Albert Schweitzer Chair at Columbia University, put it. The developing countries lost no time in bringing to the fore the economic implications and perils of environmentalism as they saw it for their own future development and well-being. As a newssheet jointly issued during the Conference by The Ecologist and Friends of the Earth also put it, environmentalism "is seen by many (in the non-industrial world) as a plot by the rich to hang on to wealth won by despoiling the environment, while depriving the poor of the fruits of development, in the name of ecological purity".

The fact that the Conference was held in such clean and affluent surroundings did little to dispel the fears of delegates from the Third World; and one could see their point of view. The tremendous and growing disparities between the industrial and non-industrial nations, hammered home day after day, must have given many Western representatives who came obsessed with their home pollution problems much food for thought.

Most communist countries, with the exception of China, Rumania and Yugoslavia, boycotted the Conference because of the exclusion of East Germany from full participation.

The Rich and the Majority debate main issues

Considerable emphasis was placed by speakers from developing countries upon the fact that for two-thirds of the world's population the human environment was dominated by poverty, malnutrition, illiteracy and misery, and that the urgent task facing mankind was to solve those immediate and formidable problems. Until the gap between the poor and the rich countries was substantially narrowed, little if any progress could be made in improving the human environment. Many speakers from developing countries agreed, however, that environmental considerations would have to be incorporated into national development strategies in order to avoid the mistakes made by developed countries in their development, to utilize human and natural resources more efficiently, and to enhance the quality of life of their peoples. Many speakers endorsed the statement of the Secretary-General of the Conference that there need be no clash between the concerns for development and environment, that environmental support must not be an excuse for reducing development and that there must be a substantial increase in development assistance with due consideration for environmental factors. There was also general agreement that a philosophy of "no growth" was absolutely unacceptable.

Many speakers from developing countries stated that there was exploitation of their natural resources by developed countries for their own purposes; some protested against the activities of certain multinational corporations. The exploitation of international marine resources by developed countries, which had a direct effect upon developing countries, was also stressed by many representatives. Many felt there must be an entirely new attitude on the part of the developed countries towards their responsibilities. Many speakers from developing countries urged the relaxation of protectionist trade barriers against their products, and several warned against the danger that developed countries might raise the prices of their goods to meet costs incurred in environmental reforms; it would be intolerable if the nations which had created the world's environmental problems should expect others to meet the cost.

* Co-author of "Only One Earth—The Care and Maintenance of a Small Planet", an official report commissioned by the Secretary-General of the United Nations Conference on The Human Environment, prepared with the assistance of a 152 member committee of corresponding consultants in 58 countries. Published by Norton, price $6.

The need for regional co-operation among developing countries was mentioned by many speakers. Some said that it was only through national initiatives and work that the problems of developing countries could be solved, but others added that such initiatives and work should be undertaken with regional and global co-operation. The need for technical and scientific assistance for the developing countries was emphasized by many speakers, as was the importance of effective international dissemination of information.

Several speakers expressed concern at the inadequacy of existing knowledge concerning environmental problems, and stressed the urgent need to initiate international research programmes, the results of which would be freely available to all. Some speakers considered that the establishment of such programmes would be the most important single contribution that the proposed body, which could be charged with the work that the Conference had initiated, could make in its formative stage. Several speakers considered however that that would not be sufficient, and that the basic need was for a major programme of education in the poorer countries, as it was only through the eradication of illiteracy and ignorance in all sectors of society that mankind could hope to improve its opportunities and conditions of life.

Many Solid Achievements

Not that the Conference was without its decided gains. As Mr. Eldon Griffiths, the U.K. Under-Secretary of State for the Environment put it in conversation with me, the Conference achieved three main objectives to which the U.K. delegation attached great importance, namely;

(a) agreement to take early action on ocean dumping,

(b) the setting up of a global monitoring system,

(c) the setting up of a world-wide referral system.

Furthermore, the Conference agreed to the proposals to set up a small permanent environment secretariat to be headed by an Executive Director who shall be elected by the General Assembly on the nomination of the Secretary-General. It was also recommended that the General Assembly establish a Governing Council for Environmental Programmes composed of 54 Member States, elected for 3-year terms on the basis of equitable geographical distribution. A voluntary fund would be established to finance the Programmes and a target of $100m was spoken about.

The Conference was notable for the surprisingly scant attention given to many of the specific issues vitally affecting industry such as the motor vehicle, roads, pesticides and oil concessions to mention but a few.

Much time was, however, devoted to the subject of ocean dumping, and the debate was closely followed by the Oil Companies International Marine Forum (OCIMF) representatives* who are separately reporting on this to their Forum in greater detail. Governments were recommended fully to participate in a conference to be convened by the U.K. Government in consultation with the Secretary-General of the United Nations before November 1972, and in the 1973 IMCO Conference on Marine Pollution and the Law of the Sea Conference scheduled to begin in 1973 with a view, *inter alia,* "particularly to complete elimination of deliberate pollution by oil from ships, with the goal of achieving this by the middle of the present decade".

* Messrs. Fyffe Gillies, J. R. Keates and C. A. Walder.

One of the recommendations of the Committee dealing with "Identification and Control of Pollutants of Broad International Significance" was that approximately ten baseline stations be set up in areas remote from all sources of pollution to monitor long-term trends in atmospheric constituents and properties which may cause changes in meteorological properties including climatic changes, and a much larger network of not less than 100 stations be set up for monitoring properties and constituents of the atmosphere on a regional basis.

These sort of recomendations reflected the widespread recognition within the Conference itself of the crucial need in many fields for very much more scientific research as a basis for action.

Most of the labours of the Conference centred on an Action Plan—discussing, redrafting and voting on some 120 proposals. Some of these fell by the wayside, some were diluted to the point of impotence. Those that were approved form recommendations, some directed to Governments and the remainder for international action. All will have to surmount the United Nations General Assembly session this autumn. If ratified they will form the world's instructions to the new United Nations environment secretariat. A check list of the major proposals affecting industry that were approved is given in Appendix 2.

"Club of Rome"

But overshadowing even the split between the rich and the majority was the intense concern voiced by intellectuals of world renown such as Barbara Ward, René Dubos, Margaret Meade for the future well-being of the world in the very broadest sense, highlighting such issues as growth rates, depletion of natural resources, man's very survival.

The extreme views of the doomwatchers and the technological optimists were typified by Dr. Aurelio Peccei, President, Club of Rome, and a leading Professor of Economics, respectively.

Dr. Peccei's address to the International Institute of Environmental Affairs evoked great excitement and one could not fail to be impressed by his evident concern and sincerity. He was frank enough to say at a Press Conference that the Club of Rome's study "Limits to Growth" had in his opinion very many shortcomings, and he did not pretend to offer any particular solutions to what he saw as an environmental crisis of potentially devastating proportions. How soon this might come about is a matter for conjecture. His prime concern was to urge mankind drastically to re-orientate its way of living while there was still time. Conscious as they were of the slender basis for many of the findings of "Limits to Growth", the Club of Rome had commissioned a further study.

"Only One Earth"

Time alone will tell whether this Conference will prove to be a real water-shed in the thinking of world opinion formers on The Human Environment. After a distinctly shaky start when it began to appear that the sharp divisions between the rich and the majority could split the whole Conference asunder, there emerged after two weeks of dialogue the beginnings of a common understanding. On the one hand there was a recognition by the rich that their own problems, though sometimes serious should not be solved at the expense of the poor; on the other hand, there was a recognition by the poor that in developing their economies on which they had set their hearts, they should endeavour to avoid repeating the mistakes of the industrialised countries.

Industry as such was never seriously a target for attack, being literally dwarfed by the magnitude of the political and environmental issues that found expression in the Conference.

In the end the Conference served to give meaning to its slogan "Only One Earth".

In the words of one commentator, "The nations of the World have shown they can agree on what ought to be done. Now they have to do it".

APPENDIX 1

Subject Areas

I Planning and management of human settlements for environmental quality.
II Environmental aspects of natural resources management.
III Identification and control of pollutants of broad international significance.
IV Educational, informational, social and cultural aspects of environmental issues.
V Development and environment.
VI International organisational implications of action proposals.

APPENDIX 2

Major Action Proposals Affecting Industry*

I. Planning and Management of Human Settlements for Environmental Quality

Development assistance agencies should give higher priority, where justified in the light of social benefits, to supporting Governments in financing and setting up services for water supply, disposal of water from all sources, and liquid-waste and solid-waste disposal and treatment as part of the objectives of the Second United Nations Development Decade.

WHO should increase its efforts to support governments in planning for improving water supply and sewerage services through its community water supply programme, taking account of, as far as possible, the framework of total environment programmes for communities.

The Secretary-General should ensure that during the preparations for 1974 World Population Conference special attention be given to population concerns as they relate to the environment, and, more particularly, to the environment of human settlements.

The intergovernmental body for environmental affairs to be established within the United Nations should ensure that required surveys be made concerning the need and the technical possibilities for developing internationally agreed standards for measuring and limiting noise emissions and that, if it is deemed advisable, such limitations be applied in the production of motor vehicles and certain kinds of working equipment.

II. Environmental Aspects of Natural Resources Management

Steps should be taken to arrange that systematic post audits of completed natural resource development projects be undertaken in representative ecosystems of international significance.

Ensure that a programme to expand present data gathering processes so as to assess the total economic value of wildlife resources is established.

* Subject to any necessary amendment when final documents are received.

A study to be undertaken on available energy sources and consumption trends in order to plan for and forecast the environmental effects of future energy use.

WMO should initiate or intensify studies on the interrelationships of resource development and meteorology.

FAO should co-ordinate and strengthen international co-operative research on soil capabilities and conservation.

Continuing surveillance of the world's forest cover should be provided for through the establishment of an appropriate monitoring system.

Collection, measurement and analysis of data relating to the environmental effects of energy use and protection should be undertaken within appropriate monitoring systems.

The Secretary-General should provide the appropriate vehicle for the exchange of information on the environmental impact of mining and primary mineral processing.

The Secretary-General should give special attention to providing a mechanism for the exchange of information on the environmental impact of energy processing, transportation and consumption.

Governments should agree to an International Programme to preserve the world's genetic resources.

FAO under its programme "War on Waste" should place increased emphasis on control and re-cycling of wastes in agriculture.

III. Identification and Control of Pollutants of Broad International Significance; International Organisational Implications of Action Proposals

Governments to use the best practicable means available to minimise the release to the environment of toxic or dangerous substances, especially if they are persistent substances such as heavy metals and organochlorine compounds, until it has been demonstrated that their release will not give rise to unacceptable risks or unless their use is essential to human health or food production, in which case appropriate control measures should be applied.

When establishing standards for pollutants of international significance, Governments should take into account the relevant standards proposed by competent international organisations, and concert with other concerned Governments and the competent international organisations in planning and carrying out control programmes for pollutants distributed beyond the national jurisdiction from which they are released.

Governments should actively support, and contribute to, international programmes to acquire knowledge for the assessment of pollutant sources, pathways, exposures and risks.

Plans should be developed for an International Registry of Data on Chemicals in the Environment.

The feasibility should be explored with the International Atomic Energy Agency and the World Health Organisation of developing a registry of releases to the biosphere of significant quantities of radioactive materials.

Appropriate United Nations agencies should develop agreed procedures for setting derived working limits for common air and water contaminants.

Recommended that Governments, with the assistance and guidance of appropriate United Nations bodies, in particular GESAMP*

- accept and implement available instruments on the control of the maritime sources of marine pollution;
- ensure that the provisions of such instruments are complied with by ships flying their flags and by ships operating in areas under their jurisdiction and that adequate provisions are made for reviewing the effectiveness of, and revising, existing and proposed international measures for control of marine pollution;
- ensure that ocean dumping by their nationals anywhere, or by any person under their jurisdiction, is controlled and that Governments continue to work towards the completion of and bringing into force as soon as possible of an over-all instrument for the control of ocean dumping as well as needed regional agreements within the framework of this instrument, in particular for enclosed and semi-enclosed seas, which are more at risk from pollution;
- refer the draft articles and annexes contained in the report of the intergovernmental meetings in Reykjavik, Iceland, in April 1972 and in London in May 1972 to the United Nations Seabed Committee at its session in July/August 1972 for information and comments and to a conference of Governments to be convened by the Government of the United Kingdom in consultation with the Secretary-General of the United Nations before November 1972 for further consideration with a view to opening the proposed convention for signature at a place to be decided by that Conference, preferably before the end of 1972;
- participate fully in the 1973 IMCO Conference on Marine Pollution and the Law of the Sea Conference scheduled to begin in 1973, as well as in regional efforts, with a view to bringing all significant sources of pollution within the marine environment, including radio-active pollution from nuclear surface ships and submarines, and in particular in enclosed and semi-enclosed seas, under appropriate controls and particularly to complete elimination of deliberate pollution by oil from ships, with the goal of achieving this by the middle of the present decade;
- strengthen national controls over land-based sources of marine pollution, in paritcular in enclosed and semi-enclosed seas, and recognise that, in some circumstances, the discharge of residual heat from nuclear and other power stations may constitute a potential hazard to marine ecosystems.

IV. Educational, Informational, Social and Cultural Aspects of Environmental Issues

General recommendations were made for international action, with continuous social diagnosis, education, published information, participation, conservation and creation, and exchange of information.

Recommended that the Secretary-General should take the appropriate steps, including the convening of an expert meeting, to organise an International Referral Service for sources of environmental information.

* Joint Group of Experts on the Scientific Aspects of Marine Pollution (IMCO/FAO/UNESCO/WMO/WHO/IAEA/UN).

Such a service would enable the maximum benefit to be gained from the exchange of information about local, national and international research, application, and legislative and management experiences in environmental matters.

The users of the Referral Service would be governments and bodies of the United Nations system. The Service could be gradually extended to other users, subject to the availability of financial resources.

V. Development and Environment

Recommendations were made relating to regional co-operation, international trade relations, international distribution of industry, international financing for environmental action and international development strategy. Regarding international distribution of industry it was recommended that Governments of the developing countries should consider fully the new opportunities which may be offered to them to establish industries in which they may have comparative advantages due to environmental considerations, and that special care be taken in all such instances to avoid creation of pollution problems for developing countries. Industries specifically named included the petroleum and chemicals, metal extracting and processing, pulp and paper industries.

It was further recommended that GATT and UNCTAD should consider undertaking to monitor, assess and regularly report the emergence of tariff and non-tariff barriers to trade as a result of environmental policies.

VI. International Organisational Implications of Action Proposals

Discussion centred on five main topics:

(i) the size of the proposed Governing Council;

(ii) the location of the headquarters of the proposed environment secretariat;

(iii) the matter of contribution to the fund;

(iv) the possibility of convening a second United Nations Conference on The Human Environment; and

(v) the role of United Nations agencies.

Recommendations:

(i) the size of the Governing Council should be 54 Member States;

(ii) location of secretariat: cities mentioned were Nairobi, Kampala, Madrid, Mexico City, Vienna and Geneva. Further proposals may be received up to the 16 July, 1972;

(iii) financing: although a target figure of $100m was spoken about, this figure was not actually quoted in the official draft report of the Committee. Several Governments offered specific contributions.

(iv) Proposal for second United Nations Conference: left for further consideration by the United Nations General Assembly in the Autumn of 1972.

(v) The role of agencies: it was made clear that the ultimate authority for the approval of programmes rested within the agencies concerned and their respective governing bodies.

THE GIVE AND TAKE OF TECHNOLOGY

by

J. W. Barrett, C.B.E., Ph.D., C.Eng., F.R.I.C., F.I.Chem.E.

Director of Research (Europe), Monsanto Chemicals Ltd. Address to the Society's Annual Public Meeting at the Connaught Rooms, London, on 2nd June, 1972.

It certainly was with some considerable temerity and some reluctance that I accepted the invitation of your Director to take the place of such an eminent gentleman as Peter Walker. I can promise you that I am not in any way going to try to say what he would have said, even if I had known what it was; and I am not going to use those, shall we say interesting, subjects such as "Sinews for Survival" and "Nuisance or Nemesis", or any of these other topical subjects which are threatening us with total extinction.

I think perhaps the reason why I was asked maybe, is the fact that at the 50th anniversary meeting of the Institution of Chemical Engineers, at which I had the fortune to be presiding, we had with us H.R.H. Prince Philip. In one of his characteristic brilliant statements he recognised progress made by the Chemical Engineer and perhaps by the Clean Air Society in terms which, if not quite obvious, were readily understandable. He mentioned that no longer was he able, as he once was in war years, to navigate up the North East coast of our country by his nose. This is the sort of comment which makes us recognise what great strides have been made in a very short period of time, showing what is probably a greater industrial revolution than that which we normally read about in our history books.

Now, I think we are fortunate to have a National Society for Clean Air. Its influence obviously has been considerable, but I am not going to talk about clean air as you are all so much better informed about it. I would like to take the opportunity of talking on the interaction of science and technology with society through the chemical and allied industries, and the challenge we face in harnessing science through technology to man's advantage.

Over the past fifty years, and I choose fifty years merely for convenience, but it is also a fantastically important fifty years in man's history, the world's population has nearly doubled and even that of the U.K. has increased by 25 per cent. Vehicles on the road have multiplied tens of times until today they number over 80 million in Europe and over 100 million in the U.S.A. These are figures which I do not think we would have dreamt of before the First World War and probably even after that war.

Electrical power generation has multiplied nearly 60-fold in the U.K. in those fifty years. Chemical and petroleum industries have also seen phenomenal growth, at least 20 times.

Now let me bear just a little more therefore on this remarkable growth of technology in the chemical and allied industries.

The rate of change as well as the rate of growth in the chemical industry is probably without parallel in industry's history. It has harnessed chemistry to answer the needs of man and it plays a major part in the economy and welfare of all developed countries, whatever be their politics or their ethic. It is the often-expressed wish of the developing countries to enter into more industrial production. To all of us manufacturing industry was, until some twenty years ago, a necessary, vital path to national prosperity and human advancement; science—and resulting technology—was good in its own right and benevolent and vital to man's development. Today there is not such unanimity—we see doubts of both science and industry, of scientist and engineer.

But surely such is not surprising. The rate of growth of science and coupled technology is so great that we are experiencing in one generation changes of magnitude previously spread over centuries. It would be remarkable if all effects were good, and if some of the most beneficial aspects of advanced technology were not accompanied on occasions by less desirable, even unpleasant ones.

Now the pressure from us—total humanity—upon science has been growing as population increases and needs become greater. We have yet to learn, and by "we" I mean all of us, how we can be certain of the total safety of the application of the ever-advancing scientific knowledge to meet our needs and prejudices; and we do have prejudices as people and it is some of these prejudices which influence industry and the development of technology.

Let us look at a few of the major contributions from technology and perhaps some associated potential disadvantages and the interplay between these various innovations or developments.

As early as the 1890s, a little before the birth of this Society, scientists had expressed concern after the discovery by some biologists of denitrifying soil bacteria. These are the bacteria in the soil that remove fixed nitrogen. Because of this discovery the scientists became alarmed that the nitrogen in the soil which was available for plant growth would be diminished and that farm productivity would therefore be severely limited.

In those days Chilian saltpetre, a naturally occurring fertiliser, had to suffice to fill this gap of nitrogen requirement with the increasing need for farm crops. This situation continued until the First World War. In that war the drive for explosives as well as the drive for food production led the German technologists and scientists to bring about the fixation of nitrogen by artificial means. They were able to take nitrogen from the air and by chemical processes convert it to ammonia which the soil needs as a source of food for plants. The names of Haber and Bosch are famous names in the history of science and technology. They brought about a major change to the industry because for the first time a very large and continuous process came into being. Chemical engineering perhaps began about that time.

Today the production of synthetic ammonia is vast, over 30 million tons in the world. Without it food production to feed the 2,000 million new people since 1900 would have been impossible. To deal with the new population in front of us, which is going to be twice that figure, we may well have to increase production of ammonia to some 100 million tons.

The enormity of the food problem is perhaps best shown by the estimate that the grain production of the world will have to be increased by two or three times its present size by the year 2000, which means a larger increase in the next 30 years than has been brought about in the whole of the thousands of years since agriculture began.

However, despite the great advantage that fixed nitrogen and synthetic ammonia brought to the world's population, it brought some problems too. The so-called "run-off" of soluble fertiliser into lakes encourages in those lakes algae growth, which depletes the lakes' necessary oxygen and brings death to fish. This is a recently recognised phenomenon and is a real problem in parts of the world but not at this moment in time in this country.

So we see a strange reversal of the position; initially we were concerned that nitrate disappeared too fast from the soil because of bacteria there; now we are concerned with nitrogen leaving the soil too quickly into the waters from which we have to take our drinking supply. This balance of good and bad is always a difficult one to make and new technology may affect the balance in one way or another.

It is well known that a large part of human food protein comes from animals fed on grain, grass and other crops; this is classical animal husbandry. The animal is our converter of carbohydrate in the grass to protein. The scientist has recognised for some time that other converters, apart from animals, are able to produce the proteins which we all need. Micro-organisms such as yeast and algae can live on many carbohydrates and also hydrocarbons, building protein whilst they are doing it. Thus we see already the petrochemical and process industries moving to the harvesting of micro-organisms, such as yeasts, for manufacturing the protein which these micro-cellular organisms have produced. And so a remarkable change occurs where some protein will be obtained from hydrocarbons through the use of micro-organisms which "eat" it, and build up protein which is then harvested for human use. What effect this change in technology will have on the other balance of ammonia in the soil is one of the puzzles we have got to face.

A further instance is that at an earlier date the chemical industry was reacting to the world demand for food in another way, in this case for the world demand for fats. Soap is a major user of the same fats used for food and replacement of soap by products not using natural fats looked economically desirable, socially beneficial and perhaps more effective. Hydrocarbons from the oil industry were a natural starting point for the chemist and it is well known how in World War II the Germans oxidised oil fractions which they had obtained from their coal-to-oil programme to make substitute fatty acids which were actually used as ersatz butter at times. They developed these fats for use in detergents to replace soap. The 50's saw a rapidly increasing replacement of soap by these synthetic detergents which were made largely from products from the oil industry. One particular variety is called alkylbenzene sulphonates.

These materials were made by the chemist in the belief that they were effective, that they were useful, and that they were benevolent; and everything seemed very good. In fact, in the United States in a relatively few years 50 per cent of the total soap requirement was replaced by these synthetic detergents. But then our rivers began to foam and our sewage plants developed symptoms of lower efficiency. This time the micro-organisms which we had been putting to use previously for making good food were now working against us for it soon became clear that these particular detergents, alkylbenzene sulphonates, were not broken down by the bacteria which are used in sewage plants to break down the detritus of human living. However, a concerted technical attack by the scientists in industry resulted in modified materials which those bacteria could consume and so the balance between adverse and benign technology had been rectified. There is not only one answer, there are many, and some of our problems are concerned with the seeking of the answer which balances the benign with the undesirable.

Another instance of what has been happening in this remarkable fifty years is the demand for transport, again due to the growth in population and the convenience that people want. The Second World War conspired to make natural rubber supplies on which most of our road transport travelled insufficient and we saw in Germany and the U.S.A. the production of man-made rubbers to supplement and, in certain cases, replace the natural rubber completely. These synthetic rubbers needed materials or chemicals which had not previously been made in bulk quantities. They included such things as butadiene and styrene which are commonplace names to the chemist now, but fifty years ago—in fact thirty years ago—were really chemical curiosities. These materials are made in very large quantities by the industry, by processes using quite extreme temperatures, often extreme pressures and involving the utilisation of highly toxic materials. It would be quite difficult today to visualize how world needs for transport would be met without the synthetic rubber supply, all generated since the 30's of this century. New chemistry translated into new product by the technologist and into great commercial production by the engineer has indeed complemented the work of the earlier mechanical engineers who perfected the internal combustion engine on which so much of our transport depends.

But of course there is another problem. In the 30's new chemistry had given another great boost to the internal combustion engine with the brilliant discovery that tetraethyl lead could delay combustion of hydrocarbons and hence upgrade the oil fuels to give added power and smoothness to the engine, for the benefit of us all. Process and plant for this new product rapidly came into being; its widespread use encouraged the extraction of bromine from sea water to help produce the necessary intermediate ethyl bromide. The oil industry responded with continuing large increase of motor fuel until in 1970 we see its production, matching the need of the 83 million road vehicles in Europe, to be over 72 million tons of motor gasoline and 175 million tons of gas and diesel oil.

Without our road transport system it would be difficult to sustain our way of life and the major human advantages of free movement. But it is clear that disadvantages and undesirable effects increase and put new demands on the chemical, mechanical and civil engineer; on the chemist and the physicist, to remove the threats of toxicity from burnt fuels which is now a popular and real problem, to reduce the road accident rate, to lessen the noise level of the individual vehicle and total traffic system, and to modify and create roads sufficient for the need. Indeed the present demand is so to contain the undesirable effects of the complex of fuel, engine and vehicle without removing its advantages—present and potential—to us all who treat the system as a necessity rather than a luxury of life.

We should be sustained in our belief that such containment and answers can be brought about by the powers continuously given to us by science. The record has been good so far; it is how you use your science which is the important thing.

All of us have heard of the rise and fall of DDT which is another fascinating example of how science brings good and at the same time associated trouble. Its discovery in 1948 by Paul Hermann Müller earned him a Nobel Prize, and Nobel Prizes are not given lightly; they are given particularly for discoveries, inventions and advances which are to the benefit of the human race. The contribution of DDT to the control of malaria by destruction of the disease-bearing mosquito was hailed by all, but in 1970 it was banned by law in the United States and some other countries. Residues of it had been found widely spread in the animal and bird kingdom and disturbance of the reproductive cycle of birds had been suggested. There had been no real evidence whatsoever with regard to toxic effects on man himself. Well perhaps DDT is too effective and today industry and scientists seek products which disappear from the environment more quickly than does DDT, and also new chemicals which are even more specific in action than DDT. Despite this the benefits of DDT have been immense. It is not entirely discountable that it was not partly responsible for the demise of the British Empire for it freed many tropical colonies from the crushing load of the mosquito and so encouraged their search for self-government! A little bit silly maybe, but these reactions and relationships between science and technology with the total social system are complex and odd and are not yet fully understood. Certainly they are not entirely predictable and this is one of the major problems that we all have.

I would like to say something on the plastics situation but it will have to be brief, whereas the subject is large, growing, complex and of enormous potential. Now, the plastics situation is a very big one. By that I mean that plastics have grown enormously, more rapidly than any other product that we have made, apart from synthetic fibre. The commercial development of a typical plastic, polystyrene, began only some thirty years ago. Its utilisation since has spread over a vast number of products. One example is the expendable hypodermic syringe—undoubtedly a major factor in controlling infective hepatitis. Another use which has attracted obvious attention has been the use of polystyrene for the napalm incendiary bomb which was used in the Far East by the Americans. And so again you see how the utilisation of a product springing from technology can go one way or the other, indeed many different ways, some looked upon as good, some looked upon as bad. The polyethylenes and polypropylene have developed in even a shorter time span and have found even a greater variety of uses. Within twenty years production has increased 20-fold and today there is a world production of 30 million tons.

A few of the audience

How much more is going to be made is obviously one of our concerns, and perhaps to some people worry, because there is concern expressed at the moment on the disposal aspect of plastics. They seem to last too long and they litter the countryside; on the other hand they don't cut your feet! There is really no technical problem here because it has been shown that all plastics, that is all those in common use, can be destroyed in normal rubbish incinerators in concentrations far higher than their likely content in domestic waste. There may very well be a cost problem; there certainly is a collection problem because the major trouble arises not from the waste plastics which is in the dustbin, but from what is discharged into the environment by those people who do not observe a good code of protecting the countryside. Nevertheless industry works towards alleviating the problem and I am quite sure that there will be plastics which disappear more quickly and plastics which can be reused. The balance of the desirable and the undesirable in plastics is a changing one. The inter-reaction between the human need, the social requirement, the social behaviour, and science and technology is so complex it is very difficult to predict the outcome except in the continuing application of polymer and plastics technology to man's advantage.

Even more impressive is the story of nylon. To most of us nylon is a real classic of modern technological development. It became the first fully synthetic fibre and was created only some twenty to thirty years ago to aid in the clothing of the increasing population of the world. It was a major triumph of man to move to a fully man-made fibre in which both chemical structure, that is its make up as a chemical, and its physical structure, played their part in imitating what nature had long provided in animal fibres such as wool, and plant fibres such as cotton. The growth has been remarkable; it is anticipated that man-made fibres, mostly nylons, polyesters and acrylics will represent more than 50 per cent of all fibre used in Europe in 1980. To date, I believe it is fair to say, that there has been no detectable environmental problem. There is little doubt that without this development clothes would be far more expensive, less varied, far more difficult to clean and often not so convenient to meet the demands of modern life and travel.

Health and Industry are also inextricably entwined. I have mentioned a few of the bad effects of man-made products on health but overwhelming is the benefit brought to man by synthetic drugs, anaesthetics and even pesticides. There is no need for me to recount the advantages brought by sulphonamides and antibiotics. Although perhaps there is need because in talking to my children they do not realise that the deaths from such common things as diphtheria and pneumonia when I was a child were the enormous concern of my parents.

Today that concern is gone; perhaps we do have to remind ourselves of what a transformation there has been in lessening the anxiety of people brought about by the easier maintenance of health of their young. Perhaps less obvious are the enormous advances in the treatment of mental disorders by new chemicals. Outstanding has been the contribution of Chlorpromazine which revolutionized the treatment of psychosis enabling many people to live at home instead of in hospital. There are few drugs which have equalled the impact made by Chlorpromazine on psychiatry, medicine and perhaps total society.

The interaction of science and society, often through the chemical and allied industries, is very complex as I hope just one or two of the examples I have mentioned show. I think the challenge is "Where do we want to go and what has science and technology got for that purpose?", not "Where does science and technology lead us " Science and technology are for us, they are man-made and it is for us to use them to the purpose which we decide. The power given to man by science is enormous to answer his demands and satisfy his prejudices; fixation of nitrogen of the air for plant food; the transmutation of coal or oil to drugs, plastics, textiles, even to food; the curing of disease and, alas, the greater capability to kill. But it is not yet given to him to anticipate all the effects of technological innovation, to avert all the undesirable, to identify all the benefits.

The hazard of misuse becomes larger at the same time as the advantages from technology increase. The major and continuing growth of scientific knowledge and of our power to apply it through technology therefore demands an ever increasing capability of judgment.

Modern chemical industry has become very efficient in a technical sense. The 20th century science and practice of chemical engineering has enabled industry to improve yields and performance, to drop the cost of products and build very large plants to cope with human demand. Despite this growth, the extremes of pressure and temperature, and the toxicity of materials used in many chemical processes, the containment of hazard is very high. It is largely because of the intense awareness of such hazards by the scientists and engineers in the industry that the accident record is now better than the average of all industry, and major effort continues to reduce it still further. We must be just as efficient at eliminating or removing unwanted effluent materials as we are in producing the desirable ones. I believe greater use of chemical engineering principles, and the experience gained over the last thirty years in the chemical industry, can lower the cost of effluent disposal and treatmnt, and contain the production of undesirable by-products. In other words we have some tools, we have some experience and they have got to be used further.

Surely mankind is much better for the advance of technology. Those who would wish to turn back the clock to recreate a simpler way of life do not face the basic impossibility of feeding, clothing, keeping in health and satisfying the teeming millions on this earth without the use of man's own scientific and technical knowledge and capability. But there must also be an increasing effort to ensure that modern society's vital support systems disrupt as little as possible mankind's essential harmony with nature. The scientist and engineer have major parts to play but the whole of our society must play its part in determining the quality of the environment we want at a price we are willing to pay, and it is a capital WE, not the industry, not the government. In the area of environmental protection I believe that it is essential that the parallel lines of individual interests and specialised knowledge do meet in the general interest.

There are no instant answers to these complex problems partly, as I indicated, bcause science itself is what one would call "an open ended subject"; there is always something new coming along which will elleviate problems, bring new benefits and introduce new problems. The full involvement of the major learned scientific societies—such as the Chemical Society—and the major professional institutions—such as the Institution of Chemical Engineers—is ever more important because of their impartiality and their collective knowledge which if properly applied can certainly reduce and maybe eliminate many of the problems that we are talking about. Your Society and similar bodies will be of continuing and increasing value in bringing together all points of view on which must be based the fine judgments of government, industry and the people to use technology to the maximum advantage of society, that is us, and with the minimum of undesirable effect.

3rd International Anti Pollution Show, Tokyo 8 - 13 March 1973.

Swiss Air are operating a special package arrangement to the 3rd International Anti Pollution Show to be held in Tokyo between 8-13 March, 1973. With a departure on the 1st March from London, the arrangement includes 10 nights accommodation in Tokyo from 3-13 March and one night in Hong Kong, from £376.

It is hoped that there will be a Department of Trade and Industry Joint Venture with the London Group of Building Centres. Further information of this may be obtained from:

Mr. K. R. Timmins,

Department of Trade and Industry,

Fares and Promotion Branch,

Hillgate House,

26 Old Bailey,

London EC4M 7HU.

Telephone: 01-248-5757 Ext. 7104.

or

Mr. C. D. Collins,

London Group of Building Centres,

44 Calthorpe Road,

Birmingham 15.

Telephone: 021-455-9600.

Further information on the package arrangement appears on page 8.

Information on the 3rd International Anti Pollution Show will appear in the next edition of this publication.

THE GRAVELLY HILL PROJECT

This paper was presented to the Standing Conference of Co-operating Bodies

by

F. REYNOLDS, C. Eng., F.R.S.H., M.A.P. H.I., M.Inst.F.

Chief Air Pollution and Noise Abatement Inspector, City of Birmingham

The Scene

The Gravelly Hill motorway interchange, linking the City of Birmingham Expressway to the M6 and to the rest of the motorway network has received a tremendous amount of publicity during the past three years or more.

The impact of this £11 million project on the environment of the north-western part of the City is dramatic. The M6 sweeps south and south-east in an arc from its junction with the Walsall Road (A34; junction No. 7) to its junction with the Chester Road (A452; junction No. 5). The Gravelly Hill interchange (junction No. 6) is at the centre of the sweep, and is the meeting places of the M6, the A38, the new Aston Expressway A38(M), Tyburn Road and Slade Road. It has three levels of carriageway involving 1·2 miles of motorway, 2·2 miles of expressway and 2·5 miles of connecting roads. Approximately 3·5 miles of the Gravelly Hill section and adjoining motorway are elevated and are the longest motorway viaduct in the country. (This interchange is shown in Fig. 1).

An automatic traffic count at the Salford Bridge gyratory (the existing A38 junction with the A4097 and a local district road, Slade Road) from 1 November, 1971 to 5 November, 1971 showed that the weekday average traffic flow was over 54,000 vehicles, with peak flow occurring on Friday, 5 November—over 60,000 vehicles. Much of this traffic will be diverted to the expressway/motorway when it is opened, but with the completion of the Gravelly Hill section and the opening of the Midland Links complex, the through M6 motorway will generate increased traffic flow in the area and over 200,000 vehicles/day will be using the interchange.

The area is now somewhat topographically unique in the country in that it is at the centre of a major motorway complex, is low lying in a shallow basin, with two boating lakes (Brookvale Park and Aston Reservoir), two canals, a river and three cooling towers of a moderate size power station, all in close proximity to the junction. The motorway complex and the adjoining major roads are situated in a heavily congested urban area with good quality residential property rising on a slight slope to the north-east of the complex and mixed industrial/residental development to the west and south.

The Problem

The problem was posed by a number of scientific/academic staff of Birmingham and Aston Universities and by others, notably Reading University, during April 1971 as a part of the problem of lead in the environment. At that time Gravelly Hill was cited as a potentially hazardous area in which (one academic was quoted as saying) it would be unwise to raise children after the motorway complex opened. This general statement and the alleged potential hazards were given wide publicity in local and national press as a result of which some members of the City Council pressed for an enquiry.

Immediately Professor Page of the Chemistry Department of the University of Aston offered to the Health Committee the services of the University to establish monitoring stations around the complex before and after the motorway opened, in order to obtain a "before and after" picture of the atmospheric lead concentration. The University would correlate the results with blood-lead levels of people living and working in the area, with traffic flow and with meteorological conditions. In due course, a report would be prepared to incorporate all the relevant data and the University would produce a model from which future pollution levels could be predicted.

The Health Committee accepted the offer and provided the University with a £3,000 research grant for the two year project commencing 1 July, 1971. The project is under the control of Dr. J. D. Butler of the University and a research student, working for a M.Sc., has been appointed to carry out the work and to produce a thesis.

The Measurement of Atmospheric Lead and Sulphur Dioxide

The University was able to obtain from the Esso Research Centre, Abingdon, five instruments each capable of taking sixteen sequential samples of SO_2 and suspended particulate matter. The equipment which was described by Labdon and Fuller in paper SCCB 77/7 presented to the Standing Conference, 25 October, 1971, contains sixteen dreschel bottles and 16 filter heads holding 0·8 um millipore filter units. The flow rate through the filter units has been calibrated to 17 1/min.

Three units are permanently sited:

(a) Lichfield Road (A38) close to the Salford Park entrance.

(b) The centre of the Salford Bridge gyratory, housed in the "amenities block".

(c) At the junction of Copeley Hill and Slade Road.

Two other units will be used for short-term surveys at a selection of sites around the complex but housed wherever possible in Local Authority premises—mainly schools.

The timing mechanism of each unit is set to sample air (a) from 0728 hours to 1902 hours, and (b) from 1919 hours to 0658 hours; thus the units operate for two × 11½ hour periods each day, each period using one SO_2 bottle and one millipore filter; they therefore require only weekly attention (similar to the 8 port National Survey volumetric instruments), and produce results which can be compared, night-time:day-time.

Lead determinations of the arrested solids in the millipore filters are carried out by atomic absorption spectrophotometry at the University. Work is also proceeding to equip a mobile caravan with a second atomic absorption spectrophotometer so that "road-side" lead determinations can be made by sampling air direct into the atomic absorption unit continuously, or for intermittent periods of time.

Fig. 1.

Measurement of Traffic Flow

The M6, the Interchange, the expressway and connecting roads are to be linked to a central Police control system at the newly built Perry Barr control centre. Sub-surface loop detectors located at suitable points in the motorway system will detect individual vehicles and transmit information to a digital computer at the control centre; the computer will present the results to an operator who, amongst other things, will control speed indicators, warnings, traffic diversions, etc. In due course, traffic will also be controlled by closed circuit television.

Unfortunately, the computer installation is several months behind schedule and to enable the traffic flow detectors to operate for the purpose of this exercise, it has been necessary to involve the Department of the Environment and the Traffic and Road Research Laboratory, to install a temporary system.

Additionally to enable an overall picture of traffic movements and total flow to be obtained, we have installed sub-surface loop detectors on Slade Road, Gravelly Hill, Tyburn Road, and Lichfield Road at their entrance to the Salford Bridge gyratory.

Involvement of the Department of the Environment and the Traffic and Road Research Laboratory

During Septemebr 1971, the Health Committee decided that the project was of national importance and considered that Department of the Environment financial support should be requested for the installation of the traffic flow detectors on the motorway complex and also at the Salford Bridge gyratory. This request was eventually passed to the Traffic and Road Research Laboratory and negotiations commenced.

The staff of the Traffic and Road Research Laboratory were enthusiastic about the project and promised support. They considered however that it should be enlarged to enable the University to monitor for carbon monoxide, oxides, of nitrogen, hydrocarbons and total oxidants; and that further on-site meteorological measurements would be made. This additional work would be for a two year period from July 1972 to July 1974 and it may therefore be necessary to extend the local authority/University of Aston investigation of atmospheric lead for a further year.

At the time of writing this paper, a Contract is being negotiated between the three parties in which it is anticipated that the local authority lead survey will be supported by financial assistance from the Traffic and Road Research Laboratory and the local authority will become involved with the wider based project.

The contribution of the Traffic and Road Research Laboratory direct to local authority costs is being negotiated at £2,250 for installation of the traffic counters at Salford Bridge, plus the cost of the modifications necessary to the motorway traffic detection system. The local authority will continue with its research grant for

lead, will provide medical support for obtaining blood-lead samples, will provide information relative to background and other levels of lead in the environment and will consider extending the project for a further year.

The Results and their Implications

This project has been commenced by the City's Health Committee because no major urban motorway interchange has been studied in depth for pollution levels or "fall-out" concentration in a congested environment at any site in the United Kingdom; and certainly no previous attempt has been made to correlate known and predicted atmospheric lead concentrations with blood-lead levels.

Whatever the outcome may be, we know that this is original research and that the result may have implications at national and international level. For this reason, the work must be factual, faultless and presented entirely without bias.

If it is found that blood-lead levels are increased as a result of any increase in atmospheric lead from exhausts of petrol-engined vehicles, or that "photochemical smog is only a motorway opening away" (as has been predicted), there is little doubt that severe pressures will be exerted on the Government to take remedial action forthwith.

The Gravelly Hill project is an exercise designed to fill some gaps in our air pollution knowledge and to answere several questions relative to the siting and planning of urban motorways.

"AT HOME"

Richborough Generating Station, Kent—26 July, 1972

The sculptured figure of a Kent coal miner in the grounds of Richborough Generating Station is rather outdated now as the station has recently been converted to burn residual fuel oil. Originally commissioned in 1962 as a coal fired station, work on the conversion was started in November 1970 and was completed during December 1971.

Mr Cook, the Station Superintendent gave a warm welcome to approximately 60 visitors followed by a short introduction to the station. He spoke of the enthusiastic way in which the staff and the contractors had co-operated in a major undertaking of conversion from coal to oil. Mr. Griffen, the Site Engineer for the conversion then gave a brief account of the work involved with the conversion and outlined some of the problems encountered.

A short tour of the station followed when many of the advantages of an oil fired generating station were explained. The oil burnt is a black viscous fluid which has to be maintained at a minimum temperature of 55°C so that it may be readily pumped. The oil is delivered either by rail or sea, and the station has a storage capacity of 32,000 tons.

Three boilers, each generating 390,000 kg of steam per hour have been installed. During conversion major modifications were carried out on the front wall of the furnaces; the number of burners was increased from eight to fifteen to facilitate better automated control. The three turbo-alternators are single shaft machines and have a rated output of 120,000 kilowatts generating phases at 13,800 volts. Although the cooling system utilises water from the River Stour, the station also has a recirculating system as the river is unable to supply the necessary 3·5 million gallons of water per hour.

Before conversion the station used coal with a calorific value of between 9,500 to 11,500 Btu/lb.; the heat content of the oil used is 18,450-18,600 Btu/lb. This much higher heat content is of prime importance as 60 per cent of the station's expenditure is for fuel. Ash and water content of oil is much lower than that of coal thus eliminating disposal problems.

Richborough Generating Station now operates 24 hours per day and is classified as a 'base load station' generating electricity 43 per cent cheaper than previously produced under coal firing.

Peter J. Mitchell

National Society for Clean Air

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SOUTH WALES and MONMOUTHSHIRE
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The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

Membership of the Society and Subscriptions

Membership of the Society is open to any individual, corporate body or local authority. Subscription rates are given below.

Individual Members
Not less than £3. Subscriptions can be paid by Covenant, minimum of seven years at £1.83, the balance being recoverable from the Inland Revenue by the Society. Those Members wishing to pay their subscription by Bankers order or wish to Covenant with the Society are requested to apply for the necessary forms for completion.

Local Authority Members

Population	£	
Less than 25 000	10	appointing 2 representatives
25 001 to 50 000	13	appointing 2 representatives
50 001 to 75 000	17	appointing 2 representatives
75 001 to 100 000	23	appointing 3 representatives
100 001 to 175 000	35	appointing 3 representatives
175 001 to 250 000	40	appointing 4 representatives
250 001 to 375 000	45	appointing 4 representatives
375 001 to 500 000	50	appointing 5 representatives

Over 500 000, £15 and 1 additional representative for each additional 1 000 000 of population or part thereof.

Corporate Members
Not less than £40 (appointing 4 representatives and 2 delegates in each appropriate division) or not less than £23 (appointing 2 representatives and 1 delegate in each appropriate division)

Associate Members
Not less than £3

Note: The Society's subscription year commences 1st April.

National Society For Clean Air

NEWS FROM THE DIVISIONS

SCOTLAND

Report on Annual Conference, 1972

This year the Division's annual conference was held in Inverness from the 17 to 19 May.

The proceedings opened on 17 May with the Division's Annual General Meeting at which Dr. W. A. Horne, the former Medical Officer of Health in Glasgow, retired as President of the Division and Councillor Rina T. Nealon of Edinburgh, was elected to the office. Councillor Nealon is Convener of the Health Committee in Edinburgh Corporation and Chairman of the Eastern Regional Hospital Board in Scotland. Mr I. B. Anderson, the Chief Sanitary Inspector in Port Glasgow, was elected Vice-President of the Division.

The Conference started on 18 May with a welcome from the Provost of Inverness and this was followed by a paper by Mr. E. M. Matthew, Deputy Regional Officer of the Nature Conservancy, who spoke on the work of the Conservancy with particular reference to the effects of pollution thereon.

Mr. Matthew's address was followed by a paper by Dr. W. Gibb of the Department of Pure and Applied Chemistry at the University of Strathclyde which was entitled "Sulphur Removal—from Fuel or Flue Gases?". This paper proved to be of great interest to the delegates and it is expected to be printed in a future edition of *Clean Air*.

The remainder of the 18 May was taken up by two papers entitled "Potential Hazards of Industrial Development in the Highland Region", by Dr. M. Murchison, the Medical Officer of Health for Inverness County Council and "Atomic Power", by Dr. J. Lockie, the Medical Officer for the South of Scotland Electricity Board.

Dr Murchison's paper was particularly relevant in view of the growth of industry in the North-East. He was of the opinion that there was currently little pollution in the Highland Region but recognised that with the influx of industry which would be of great economic benefit to the area the risk of pollution would increase. He felt that, to keep pollution to a minimum throughout the country, a National Ecological Unit should be established to which all concerned with environmental health should have direct access as of right.

Dr. Lockie's paper compared the advantages and disadvantages from a pollution point of view of atomic power stations with other power stations. This paper too was of some relevance as regards the existing atomic power stations at Dounray and Hunterston and the one currently being built at Inverkip.

On 19 May a further two papers were given, the first being "North Sea Oil" by Mr. T. Junor, the Information Officer of B.P. Refinery (Grangemouth) Ltd., and the second "Contemporary Sources of Air Pollution", by Dr. J. S. S. Reay, Head of the Air Pollution Division at Warren Spring Laboratory.

Mr Junor's paper, while dealing to some extent with the actual operations involved in drilling for the oil, helped greatly to allay the fears of those who felt that his company might establish a refinery on the north-east coast thereby increasing the risk of air pollution. He pointed out that it was B.P.'s intention to use, and perhaps extend, the existing refinery at Grangemouth, and to pipe the oil to the refinery.

Dr. Reay went into his subject in great detail, covering the various sources of air pollution and this proved of great interest to the delegates, particularly the local authority elected members.

The conference closed on the afternoon of 19 May with the annual luncheon.

All in all the conference was very successful with a wide range of topics being covered and the Division's gratitude is expressed to the speakers for their contributions all of which led to lively discussions. The number of delegates who attended the conference was encouraging and it is to be hoped that similar members will attend next year when the conference will be held in Edinburgh.

Thanks are also due to Inverness Town Council who provided the accommodation for the conference and a luncheon for all the delegates and to the Scottish Gas Board who provided a cocktail party for the delegates.

F. J. Feeley
Hon. Secretary

YORKSHIRE

The Annual General Meeting of the Yorkshire Division was held in the Council Chamber of the Town Hall, Sheffield, on Wednesday, 14 June 1972, and was attended by 68 members and delegates. Prior to the Annual Meeting members of the Division were invited to lunch with the Lord Mayor of the City of Sheffield, Mrs. M. Strafford. Mrs. Strafford welcomed the members of the National Society for Clean Air and paid tribute to the work which the Society was fostering and wished the Society continuing success in the future. She made particular reference to the efforts of the City of Sheffield in smoke control. The City had virtually completed its domestic smoke control programme and although problems still remained with industrial emissions constant efforts were being maintained to control these as much as possible in the light of existing technology. The Lord

Mayor paid particular tribute to Mr. J. W. Batey, Chairman of this Division and also Chief Smoke Inspector for the City of Sheffield. She said that Mr. Batey was retiring in the very near future but that he left behind him a monument in the form of the enormous improvement in the atmosphere over the City.

At the Annual General Meeting in the Council Chamber it was reported that the existing Chairman, Mr. J. W. Batey and the Deputy Chairman, Mr. E. J. Winfield, were retiring and that following an election for the replacement of these Officers Mr. L. Eastwood of Rotherham C.B. had been elected Chairman and Mr. W. B. Twyford of Wakefield C.B., Deputy Chairman.

Mr. Batey then introduced the Annual Report of the Division. He said that in looking back at the efforts made and the work done by the Yorkshire Division he was impressed by the fact that the Division was invariably either with or slightly ahead of national movements and national thought on clean air. The Executive Council, for instance, investigated the remarkable building in Leeds which is the brain child of the Electricity Board, this building has clean air filtered and conditioned inside the building, first class lighting, equable and uniform temperatures maintain the year round and no fuel used at all for central heating, no chimney and no effluent and this in a building that houses over 240 office workers.

The Division has supported the Director of the Yorkshire Council for the Environment with an offer of any technical or other support he requires. They have formed a small Sub-Committee to attempt to influence those few Authorities in Yorkshire who have not yet declared any interest in the formation of smoke control areas. They have fostered the interest which almost all take in the advent of natural gas to Yorkshire. This valuable contribution to smokelessness involving such tremendous administrative and technical problems is going ahead without headlines, yet is completely effective in its action. No smoke, no grit and dust and no SO_2. The City of Sheffield has over half a million population and over 186,000 homes will be fully converted next month.

The Council has also enthusiastically supported the Schools quiz on clean air to be held at the Scarborough Conference in October. I understand that some hundreds of children will be taking part. Members of the Council have taken a keen interest in the new development of the smokeless coal burning room heaters now on the market and, in this connection, it is notable that the demand for the cheap and unsophisticated type of approved open fire draughting 6 or 7 lbs. is now very small and becoming smaller week by week. The tremendous gap left when gas coke supply dried up has been bridged successfully. Speakers have been supplied as usual whenever requested by any organisation and the Council members have never ceased to supply information to scores of individuals who are now becoming interested in the purity of the atmosphere which we breathe. This is all as it should be.

The National Society for Clean Air is a spearhead and, if we hadn't an organisation of this nature in being over the last few years, there is no doubt in my mind that we would have had to form one.

The support shown in the attendance today is sufficient proof that the organisation is active and busy in promoting the ideals for which it stands. Mr. Batey said that he could only thank everyone concerned for the support given to him in his rather short term of office as Chairman and that he was sure that the people following him will carry on the good work which has gone on for such a long time and which, over the last few years, has shown such remarkable progress.

This is no time to hide our light under a bushel. This country, in my opinion, leads the world in the fight against air pollution and, although a lot remains to be done, a splendid start has been made. It is to be hoped that the future will be as productive as it has been in the past and that the Yorkshire Division will continue to hold its place as a leader in the fight for clean air.

Following the acceptance of the Report of the Yorkshire Division the Chairman welcomed Mr. S. Cayton, Chairman of the National Society on his first visit to the Yorkshire Division and expressed the pleasure of the members in meeting Mr. Cayton.

Mr. Cayton prefaced his Address to the Division by enlarging on the brief remarks he made in response to the Lord Mayor's (Ald. Mrs. M. Strafford) appreciation of Mr Batey's work for the city over 23 years. He referred particularly to the sense of satisfaction and pleasure which Mr. Batey must feel in seeing a job completed so effectively and universally acclaimed. Whenever Sheffield is mentioned in connection with Clean Air, the name Batey must always come to mind.

Mr. Cayton then referred to the work Mr. Batey had done as an Examiner for the Diploma in Air Pollution awarded by the Royal Society of Health. To the award of a Fellowship by that Society and the debt owed by so many public health inspectors to his kindliness and integrity in dealing with both students and candidates.

As a Member of the Executive of the National Society for Clean Air, Mr Batey, like his other colleagues from the Division, was active and articulate and his contributions to the discussion in Council or Committee were always respected. Inevitably, said Mr. Cayton, the question will be asked "what are you going to do now?" He understood that golf and wine (home-made) were the prime favourites of the moment. There were also many question papers for Scarborough Conference to be marked.

Other tributes to Mr. Batey both written and oral, referred to his work and his Chairmanship of the Division. There was a wholehearted and spontaneous general expression of goodwill and high hopes for a long and happy retirement.

Mr. Cayton then congratulated the Division on the solid progress recorded in their Annual Report, particularly the item headed "Divisional News" which indicated that the last Orders to make Bradford wholly smoke controlled were expected to be operative by July 1974, Brighouse smoke controlled by 1973 and Leeds by 1975.

Particularly gratifying he thought was the news that Hemsworth R.D.C. were accepting the need for smoke control and beginning a substantial programme to achieve it.

He also paid tribute to the support given to the Division by their co-opted members particularly the fuel industries who had done so much in providing speakers, venues for meetings and hospitality. He also referred to the Award of O.B.E. to Mrs. J. C. Cockroft, President, Women's Advisory Council on Solid Fuel, two of whose members were among the co-opted organisations.

As smoke control is extended ultimately to include the whole of towns and cities, industrial plants large and small, will be included. Any transgressions by industry will be more obvious by the suppression of domestic smoke and public demand for cleaner operation will be inevitable. This will include the Alkali Registered Processes no less than any others and Mr. Cayton thought it might be helpful if an Alkali Inspector was included among the co-opted members. Mr. Clayton thanked the Division for their invitation and the City Council for their hospitality and accommodation for the day.

In his remarks in reply to the Lord Mayor, Mr. Cayton said that when he took office as Chairman of the Society he expressed the hope that he would be able to visit most, if not all the Divisions. He did not then anticipate this would involve him in so exceptional and pleasant an occasion as the completion of the City of Sheffield's Smoke Control Programme, the retirement of so distinguished an officer as Mr. Batey and the privilege of congratulating Alderman Mrs. Patience Sheard, B.A., J.P. (Mr. Batey's former Chairman) on being honoured by the conferment of C.B.E. in the Queen's Birthday Honours.

The business of the meeting was concluded by an address by Mr. R. J. Harrison, Area Housing Development Officer, East Midlands Gas Board. Mr. Harrison said it is perhaps surprising to learn what a newcomer Natural Gas is to the energy market when one considers that the Chinese were tapping it through primitive bamboo pipes in the 3rd Century A.D. It was not until 1820 that natural gas was harnessed even in a small way in the western world and only in the United States had it begun to be exploited to any great extent. In the 1950's European discoveries of natural gas accelerated and in 1959 one of the largest natural gas fields in the world was found in Holland. Geologists had speculated for some time on the presence of gas beneath Holland, Britain and the sea between. Exploration on-shore in Britain throughout the 1950's had revealed little of interest, but then new techniques enabled us to explore beneath the hostile waters of the North Sea.

So in 1965 Britain struck lucky and discovery followed discovery in quick succession. The nation soon realised that, once again it had its own source of a major primary fuel, gas energy, on which to base a new prosperity; and it will be recalled that it was in the 18th and 19th centuries that Britain last seized the opportunity to forge ahead of other nations in the struggle for industrial supremacy when the vast indigenous deposits of coal were, and still are, exploited to provide energy for development. British natural gas has arrived at a time to meet the new environmental criteria and the ever growing demands of industrial expansion.

Whatever the reasons voiced for the use of natural gas its benefits and impact will reach every man, woman and child within the country and these benefits are both economic and environmental.

The mammoth national task of converting some 30 million domestic appliances, and 10 million commercial and industrial appliances, to burn natural gas is the biggest single undertaking of its type in the world, and, as far as the East Midlands Board is concerned our conversion programme is well on target with 822,673 of the 1,330,345 customers already using natural gas—the remaining 38 per cent of our customers will all be using natural gas by 1974 which is the target date for completion.

Total national conversion to natural gas will save the country over a 30 year term the massive sum of £1,400 million made up of savings from manufacturing plant and storage replacement. There is also £100 million saving each year on foreign fuel—oil and gas—imports.

Customers converted to natural gas get an immediate financial advantage in that natural gas tariff is cheaper than towns gas. But on the whole, the industry is at least able to look forward to some stability of fuel stock price particularly as the cost of conversion will be met by the differential. Other economic advantages are perhaps fairly obvious—reduction in storage costs—removal of costs of transportation of feedstocks—reduction in manpower—all leading to complete justification of the short period in a lifetime when each customer is inconvenienced by our conversion teams. The environmental advantages take many forms and perhaps the most important of these is the real contribution to Clean Air.

I believe I am right in saying that the 1956 and 1968 Clean Air Acts did not seek to forbid the emission of sulphur, although such prohibition would be desirable. Natural gas is virtually sulphur-free and offers this special additional advantage to the spirit, if not the aims of the Acts, and with the rapidly increasing use of natural gas it is reasonable to anticipate that sulphur pollution will continue to reduce pro rata.

Another environmental advantage brought about by the use of natural gas comes from the rundown and subsequent closure of gas works. These, so often sited within or adjacent to town and city centres did produce dust and grit pollution through manufacturing process and storage of vast quantities of coal. Coal and oil feed stocks, although shipped by rail in the main, were also transported by road—and not so many years ago, a large part of the Gas Industries business was gained from coke production which also added to road and rail congestion.

By the end of the century there could be 70 million of us in Britain—but only one thing is not going to grow—the amount of room we have to live in. That is going to stay exactly the same size. Natural gas makes a valuable contribution to our environment, for in addition to the removal of urban sited gas works, space for gas storage has been reduced dramatically. On the one hand, liquefied natural gas requires only 1/600th storage capacity when compared with normal gaseous storage. On the other hand natural gas has twice the calorific value of manufactured gas and this brings the bonus of our network of gas mains carrying twice the heat value in the same volume of space. To appreciate the real space saving qualities of natural gas it might be helpful to consider the output of just one of these shore terminals.

Barton, on the coast of Norfolk started delivering natural gas from the Leman Bank field in August 1968, and this terminal will deliver into the national pipelines an average of 4,000 million cubic feet of natural gas each day or the equivalent energy output of twenty 2,000 megawatt power stations, or of 1,000 tons of coal being burned every 10 minutes day and night throughout the year.

Therefore the transmission of vast quantities of energy underground and out of sight permits industrial and domestic expansion while making a full contribution to environmental planning and quality of life.

Britain has now a new Gas Industry with a completely new fuel offering advantages never previously attainable, but to obtain some idea of the fuel's practical contribution to Clean Air and environmental planning it may be useful to examine areas of application.

The Industry has long been front runners in providing gas for cooking, and over the years has been involved in street and domestic lighting, home laundry, water heating and refrigeration. In recent years the Industry has become the front runner in domestic central heating and space heating and even more recently we have been involved in Group and District heating reaching the epitome of success with a Total Energy scheme in the new Players factory at Nottingham, aptly called the "Horizon" factory. But it is in the field of domestic heating that a new gas market has developed and, during the past five years well over 600,000 central heating and space heating appliances have been installed in the East Midlands—this figure covers 194,000 central heating installations and 424,000 gas fires of which approximately 12 per cent of the total heating appliances have been installed in Sheffield.

The growth rate is continuing and it is the job of the Gas Industry to maintain and improve its competitive position, so that the real benefits of natural gas reaches everyone directly as well as indirectly.

J. H. Wyatt
Hon. Secretary

EAST MIDLANDS

Members of the East Midlands Division visited Radiation Parkray at Belper in two groups on the 16 and 23 March, by the kind invitation of the Director. This is not the first time that the Division had visited Radiation Parkray. The purpose of this recent visit was in particular to obtain information about the 'Coalmaster'. This is the room heater designed to burn coal smokelessly which Radiation Limited have developed. It is now being marketed for installation and meets smoke control requirements.

The members were conducted round the works by members of the factory staff and were shown all stages of the manufacture from pattern making through moulding and casting to the assembly of the finished article. Following the tour of the works members were shown the demonstration model in operation.

Tea was kindly provided by Radiation Limited at the end of the afternoon. Our thanks to Messrs. Radiation Parkray were expressed at the end of the first meeting by the Chairman, Cllr. C. H. Holland and at the second meeting by the Hon. Secretary.

E. F. Raven
Hon. Secretary

Members of the First Group

SOUTH WEST

Precis of Lecture by C. L. Goodacre, presented to the S.W. Division of the National Society for Clean Air. Bristol, 15th March, 1972.

What to do with Washington on "Car Safety and Emissions"?

It is well known that local atmospheric conditions in the Los Angeles area make it necessary to reduce as far as possible emissions of carbon monoxide, hydrocarbons and oxides of nitrogen from motor vehicle exhausts.

Thus the first local requirement of the "Motor Vehicle Pollution Control Board" was to eliminate crankcase breathing to atmosphere in favour of a closed system, thereby reducing emissions by some 15 per cent.

This was followed by legislation in 1967/8 to reduce these emissions by some 50-70 per cent which seemed about the practical limit without introducing some operational and financial loss to the car owners.

Then in 1968 the Washington Politicians stepped in and turned the reasonably based local MVPCB requirements, which were based on facts, into hard line 'savage' laws calling for an average 97 per cent reduction of pollution emissions by 1975/6 from those of 1967.

These conditions are not only unnecessarily idealistic but are proving almost impossible to achieve, at least without the addition of much expensive equipment to each car which, so far, has not proved a practical proposition.

The necessary research and development to attempt to comply with these laws is proving extremely costly to all car manufacturers of the World and would appear to be a waste of effort of the first magnitude.

There is the suggestion that this legislation is being passed in the U.S.A. in order to catch the votes of ill-informed public who are told that it will eliminate serious pollution in all U.S. cities.

The speaker considered that one must assume that the lawmakers in Washington are basically honest people who have at least a half knowledge of the problems they are trying to deal with. Thus they are 'easy meat' for the plausible 'expert', dishonest self-seeking politicos in and out of power, genuine 'do-gooders' and 'nut cases'.

Unless the Environmental Protection Agency can be persuaded to revert to a more reasonable progression, possibly reverting to the MVPCB 1968 law, it seems that the U.S. motor industry and soon the World industry could be so damaged that they are no longer viable. Similarly the Petroleum industry will be so dissatisfied with its business which will be no longer profitable due to marketing restrictions.

All this is unnecessarily imposed, in that there is no factual evidence today that emissions from motor cars are injuring the health of anyone anywhere in the world, or can do so in the foreseeable future.

It seems strange that the U.S. Administration appears reluctant to use the real expertise available in its Bureau of Mines which has studied the Atmospheric Pollution problem for over 100 years! Is this because the Bureau of Mines has a record of producing highly respected

factual data which does not always fit in with the emotional scare of pollution? There is plenty of evidence that relevant Bureau of Mines Reports on the subject are being suppressed.

The Air Pollution Research Advisory Committee (APRAC) sponsored by the leading professional bodies (the CRC/SAE/API) held a meeting in Chicago in 1971 which was attended by some 454 delegates from both sides of the Atlantic, heard 15 eminent Medical Doctors give papers of which there are no copies or records of discussion. The Doctors' conclusions agreed completely with the British Government White Paper, HMSO 4373/1970, in that the motor vehicle is trivial in the overall pollution problem related to Public Health.

These lectures also confirmed the findings of the Royal Commission on Environmental Pollution Report by Sir Eric Ashby's Committee in 1971. The delegates were informed that APRAC will not be allowed to publish the Proceedings of this important meeting, due to the Sherman Anti-Trust Laws. Such action against APRAC seems very stupid or plain dishonest!

The President of the U.S. informed Congress in February, 1970, that the automobile was responsible for 60 per cent of the Atmospheric Pollution in his country! APRAC proves it to be nearer 8 per cent.

It seems that the Authorities would be well advised to lay off any further attacks against the motor car and tackle some of the urgent Industrial Atmospheric and Water Pollution problems of the world.

Proposal for Action

The 'Captains' of Europe's Motor Industry should get together and coldly review their collective position. They will in all probability find that their very existence in their business is now threatened as never before. This menace being from people with at best a half knowledge of what they are planning and doing now and proposing for the future, for no logical reason, but with the power of a mis-led Government organised behind them.

These Captains can not delegate the responsibility 'down the line' to the First or Second Officers; the danger is too near. This top level team can only be: Dr. G. Agnelli, for Fiat/Citroen/Maserati/Ferrari/Alfa-Romeo; Dr. Flick, for Daimler-Benz/VW/BMV etc.; M. Dreyfus, for R. A. Renault/Peugeot; Lord Stokes, for BLMC/Lucas/Rolls Royce, etc.

These are the major producers most affected by the Muskie Bill on car emissions and the 'Top Men' should deal with the 'Top Man' who has created the crisis for them in an attempt to have the Law amended.

SMOKE CONTROL AREAS

Progress Report

Position at 30 June 1972

(Figures supplied by the Department of the environment)

	England			*Wales*			*Scotland*			*Northern Ireland*		
Smoke Control Orders Confirmed prior to 1.4.72 . . *Acres* . . . . *Premises*	3,671	1,058,365	5,168,675	8	1,097	4,979	182	97,228	448,822	42	10,132	21,542
Smoke Control Orders Confirmed (1.4.72-30.6.72) *Acres* . . . . *Premises*	91	30,413	111,148	—	—	—	12	7,421	26,762	7	1,455	4,368
Totals	**3,672**	**1,088,778**	**5,279,823**	**8**	**1,097**	**4,979**	**194**	**104,649**	**475,584**	**49**	**11,587**	**25,910**
Smoke Control Orders Submitted . . . . . . *Acres* . . . . *Premises*	82	53,428	131,988	—	—	—	1	281	18	1	70	513
Grand Totals	**3,844**	**1,142,206**	**5,411,811**	**8**	**1,097**	**4,979**	**195**	**104,930**	**475,602**	**50**	**11,657**	**26,423**
Smokeless Zones (Local Acts) in operation . . . . *Acres* . . . . *Premises*	44	3,400	41,060	—	—	—	—	—	—	—	—	—

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30th June 1972

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	47,103	37·6	193,874	35·1
Yorks & Humberside . .	226,418	60·1	744,498	63·7
East Midlands	79,087	29·5	236,472	46·2
Greater London	271,522	83·0	2,31~~1~~,780 2	87·6
North West	221 ~~212~~,661	55·3	925,773	54·4
West Midlands	97,133	39·0	437,518	41·6
South West	7,505	28·5	28,69~~7~~5	19·3
Total (black areas) . .	950 ~~941~~,429	53·5	4,87~~8~~9,61~~2~~0	62·7
Outside black areas . .	200,777		533,199	
Grand Totals	**1,142,206**		**5,411,811**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke control orders (eg: there may be some areas of open country).

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Summer 1972)** *which gave the position up to* **31 March 1972.** *They now show changes and additions up to* **30 June 1972.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern
Teesside C.B. (Nos. 7 and 8).

Yorkshire and Humberside
Leeds C.B. (Nos. 91 and 94). Morley B. (No. 42). Heckmondwike U.D. (No. 8). Brighouse B. (No. 18). Wakefield C.B. (Plumpton No. 1). Stanley U.D. (No. 4).

North Western
Salford C.B. (No. 20).

East Midlands
Ilkeston B. (No. 6).

Outside the Black Areas
Rawtenstall B. (Nos. 4 and 5). Staines U.D. (No. 12). Warrington R.D. (No. 4).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern
Gosforth U.D. (No. 2). Teesside (No. 9A). Wallsend B.C. (No. 6).

Yorkshire and Humberside
Darton U.D. (Nos. 19, 20, 21 and 22). Leeds C.B. (Nos. 99, 100, 101, 102 and 103). Mirfield U.D. (No. 12). Rotherham C.B. (Doncaster Road No. 1 and Greasbrough No. 3). Dearne U.D. (No. 8). Sowerby Bridge U.D. (No. 10). Darton U.D. (No. 23). Morley B. (No. 44).

North Western
Bolton C.B. (East and West Wards). Manchester C.B. (Charlestown). Oldham C.B. (Nos. 22 and 23). Preston C.B. (No. 25). Radcliffe B. (No. 7). Royton U.D. (Nos. 8 and 9). Wigan C.B. (No. 8). Accrington B. (No. 11). Bebington B. (No. 15). Birkenhead C.B. (No. 17). Dudley C.B. (No. 60). Dukinfield B.C. (No. 16). Eccles B.C. (No. 15). Brierfield U.D. (No. 6). Droylesden U.D. (No. 15). Great Harwood U.D. (No. 4).

East Midlands
Carlton U.D. (No. 9). Hucknall U.D. (No. 4). West Bridgford U.D. (No. 1). Arnold U.D. (No. 5). Derby C.B. (Nos. 23 and 24). Sutton-in-Ashfield U.D. (No. 1).

Greater London
Brent L.B. (Nos. 9 and 11). Bromley L.B. (Penge East and Nos. 16, 17 and 18). Hillingdon L.B. (Nos. 16 and 17). Croydon L.B. (No. 14). Lambeth L.B. (No. 27). Merton L.B. (No. 23).

West Midlands
Bedworth U.D. (No. 4). Sutton Coldfield B.C. (No. 21). Walsall C.B. (No. 15). Stoke-on-Trent C.B. (No. 25). Aldridge-Brownhills U.D. (No. 34). West Bromwich C.B. (Nos. 20 and 21).

Outside the Black Areas
Bedford B.C. (No. 7). Burnley R.D. (No. 1). Canterbury C.B. (No. 1). Cheshunt U.D. (No. 7). Gravesend B.C. (No. 2). King's Lynn B. (Windsor Road; Seabank and Hillington Square). Leamington Spa R.B. (Nos. 11 and 12). Marple U.D. (No. 4). Northampton C.B. (No. 5). Norwich C.B. (Nos. 2 and 3). Ramsbottom U.D. (Nos 4 and 5). Reading C.B. (No. 17). Saltburn and Marske U.D. (Nos. 2 and 3). Thurrock U.D. (No. 8). Whiston R.D. (No. 4). Colne Valley U.D. (No. 1). Harrogate B.C. (No. 1). Northampton B.C. (Nos. 4 and 8). York C.B. (No. 3). Market Drayton U.D. (No. 2). New Windsor R.B. (No. 2). Runcorn R.D. (No. 6).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern
Gateshead C.B. (No. 14). Tynemouth C.B. (No. 13). Newburn U.D. (Nos. 14 and 15). Newcastle-upon-Tyne C.B. (No. 15).

Yorkshire and Humberside
Conisbrough U.D. (Nos. 2, 3 and 4). Wath-upon-Dearne U.D. (No. 5). Stanley U.D. (Nos. 3 and 6). Leeds C.B. (Nos. 104, 105 and 106). Halifax C.B. (Nos. 17c and 18a). Barnsley C.B. (No. 15). Spenborough B.C. (No. 13). Brighouse B.C. (No. 17). Hoyland and Nether U.D. (No. 2). Royston U.D. (No. 1). Pudsey B.C. (No. 12). Bradford C.B. (East and North).

North Western
Birkenhead C.B. (Nos. 9 and 15). Barrowford U.D. (No. 5). Heywood B.C. (No. 11). Fulwood U.D. (No. 3). Droylsden U.D. (No. 16). Atherton U.D. (No. 7). Rochdale C.B. (Mayfield and Halifax Rd.). Tottington U.D. (No. 4). Ashton-under-Lyne B.C. (No. 14). Darwen B.C. (No. 11). Horwich U.D. (No. 5). Bredbury and Romiley U.D. (No. 4). St. Helens C.B. (No. 8). Bebington B.C. (No. 26(1)). Golborne U.D. (No. 3). Blackrod U.D. (No. 4). Widnes B.C. (No. 10). Tyldesley U.D. (No. 4). Warrington C.B. (No. 17). Leigh B.C. (No. 13). Dudley C.B. (No. 58). Oswaldtwistle U.D. (No. 4).

East Midlands
Chesterfield B.C. (No. 6). Chesterfield R.D. (No. 14). Mansfield Woodhouse U.D. (Nos. 3 and 7a).

Greater London
Havering L.B. (No. 6). Harrow L.B. (No. 26).

West Midlands
Birmingham C.B. (No. 160). Stoke-on-Trent C.B. (No. 26). Halesowen B.C. (No. 36). Stourbridge B.C. (No. 31). Sutton Coldfield B.C. (No. 24). Walsall B.C. (No. 14). Warley C.B. (No. 10).

Outside the Black Areas
Buxton B. (Fairfield No. 1). Todmorden B. (No. 10). Reading C.B. (No. 18). Waltham Holy Cross U.D. (Nos. 5 and 6). Cambridge B.C. (No. 3). Preston R.D. (Lea). Crewe B.C. (No. 5). Warrington R.D. (Nos. 7 and 8). Worksop B.C. (Nos. 1 and 2). Dartford B.C. (No. 12). Consett U.D. (No. 1). Grantham B.C. (No. 20). Swadlincote U.D. (No. 4). Southwell R.D. (No. 1). Runcorn R.D. (No. 7). Rawtenstall B.C. (No. 6). Aylesbury B.C. (No. 2).

SCOTLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Bearsden (No. 3). Bishopbriggs (No. 3 Auchinairn/Springfield). Dumbarton Burgh (No. 10). Port Glasgow (No. 6). Stirling County (Milton of Campsie).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Bearsden (No. 4). Dundee (Douglas). East Kilbride (South East Extension) and (South West Extension). Edinburgh (Craigmillar No. 1 (part 1)). Falkirk (No. 10). Glasgow (Ruchill). Kirkcaldy/Bridgeton Paisley (Dykebar (No. 11); (Candren No. 12); (Barshaw No. 13). Stirling County (Bonnybridge No. 2).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Dumfries Burgh (Nunwood/Hardthorn).

NORTHERN IRELAND NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Ballymena B.C. (Nos. 2 and 3). Castlereagh R.D. (No. 6). Belfast C.B. (No. 10). Newtownabbey U.D. (Nos. 5, 6 and 7).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Hillsborough R.D. (No. 3).

Erratum—On page 31 "Clean Air" Summer 1972, Colne Valley U.D. (No. 1) Smoke Control Order should have appeared under the heading "outside the black areas" and not under Central Lancashire.

AIR POLLUTION ABSTRACTS

1269 Relationships Between Outdoor and Indoor Air Pollution. Anderson, Ib. (Atmos. Environ. 6(4) April 1972). Research on air pollution has to this day mostly been focused on pollution in outdoor air, whereas relatively little attention has been paid to the modifications of the pollutants during the passage from outdoors to indoors. Even small differences in concentrations of pollutants would be of medical-hygienic importance, as the major part of the population in a modern society spends far more time indoors than outdoors. Paired 24-h samples of sulphur dioxide and suspended particulate matter were studied outside and inside a room for 7½ months. The indoor concentrations of sulphur dioxide and suspended particulate matter were, on average, 51 and 69 per cent respectively of the simultaneous outdoor values. For the two pollutants the coefficients of correlation between indoor and outdoor values were 0·52 and 0·53 respectively. The factors which determine the concentration level of a pollutant in a room are expounded, and stress is laid on the medical-hygienic importance of increasing the effects of building materials in reducing pollution.

1270 Recent Advances in Equipment and Techniques for Airborne Methods of Pollution Monitoring. Caudle, R. C. (J. of Soc. of Environ. Engs. 53, June 1972). Paper presented to the SEE Symposium on Environmental Engineering Aspects of Pollution Control. This paper describes recent developments in the application of photographic techniques and other airborne methods in monitoring various forms of pollution. In order to cover a wide range of instruments and techniques the descriptions are not detailed but most of the methods have been reported in specialised journals and references are given. This paper draws attention to the work in pollution monitoring carried out by photogrammetric engineers and scientists in this country and North America. Monitoring methods include aerial photography, infra-red sensing and optical correlation spectrometry. Applications of these methods cover traffic and car parking, industrial dereliction, pollution affecting plants, water pollution and air pollution.

1271 Aircraft Engines as a Source of Carcinogenic Pollution of the Environment (Benzo(a) Pyrene Studies). Shabad, L. M. and Smirnov, G. A. (Atmos. Environ. 6(3) March 1972). Spectrofluorescent methods of analysis have shown that soot and exhaust products of aviation engines, both piston and turbine, contain benzo(a) pyrene(BP). A modern aircraft engine releases into the atmosphere from 2 to 10 mg. of BP min-I. Extracts of aviation engine soot applied to the skin of mice induced malignant tumours in all but one of them. The ground within the airport is polluted with BP and its content diminishes with the distance from the runway. The concentration of carcinogenic hydrocarbon in aircraft exhausts is dependent on the working regime of the engine and on the character of fuel combustion. The fact that aviation has been shown to present a significant source of carcinogenic pollution is of great importance for studies of the distribution and circulation of carcinogenic substances in the environment and respect of certain practical hygienic recommendations for cancer prevention.

1272 A Cost Analysis of Waste Management in the Steel Industry,

Tihansky, Dennis P. (J. of Air Poll. Control Assoc. 22(5) May 1972). Recent Federal legislation on the implementation and enforcement of environmental quality standards requires an economic analysis of industrial waste treatment. Estimates of abatement costs provide information on the adequacy of industrial programmes to meet current standards and the likely economic impact of future controls. This paper presents cost analyses of pollution control in steelmaking at three levels of detail. The lowest level pertains to gross expenditures for equipment and its operation by nearly all American steel plants over the past two decades. The intermediate level of detail lists air and water pollution control costs in a specific steel company. Capital outlays and operating expenses are estimated for various phases of the steelmaking cycle. Complications arising from the generation of one form of pollution from control of another are noted. At the most detailed level of analysis, treatment expenditures are examined by specific department or manufacturing process. Finally, the effects of removal efficiency and waste effluent volume on total treatment costs are discussed. This study focuses on direct treatment of pollutants. It does not consider alternatives of waste reduction, such as input substitution in basic manufacturing or the introduction of new processes. However, the method of cost analysis considered here can be extended to the examination of such alternatives and thus provide a sound foundation upon which environmental policy decisions can be based.

1273 Propane as an Engine Fuel for Clean Air Requirements. Fleming, R. D., Allsup, J. R., French, T. R. and Eccleston, D. E. (J. of Air Poll. Control Assoc. 22(6) June 1972). Air pollutants in exhaust gas produced from LP-gas (propane) were studied using both laboratory engines and vehicles. The objective of the study was both to evaluate propane as a low-pollution fuel and to provide information on adjustment of engine parameters for advantageous use of propane as a low-pollution fuel. Variables in the study were air-fuel ratio (A/F), ignition timing schedule, and ambient temperature. Data comparable to that for propane relating A/F and ambient temperature to emissions are shown for natural gas and for gasoline. Results in this study showed that engines using propane as compared with gasoline can operate over a wider range of A/F with minimum carbon monoxide and hydrocarbon emissions. Propane and natural gas emission levels were similar. No significant difference in nitrogen oxides was found for the three fuels. In simulated typical city driving using propane as a fuel, emissions were markedly reduced by retarding ignition timing with A/F increased to approach the lean misfire limit. However, serious power loss accompanied engine adjustment for minimum emissions. In addition to favourable lean-limit characteristics, propane offers two other advantages as low pollution fuel: (1) Mixture enrichment during starting and warm-up is unnecessary and an emission penalty during warm-up is avoided. In addition, carbon monoxide and hydrocarbon emissions with propane are unaffected by ambient temperature —in contrast to highly significant increases in emissions at low ambients with gasoline. (2) The photochemical reactivity of hydrocarbon emissions from propane, although higher than those from natural gas, are lower than the reactivity of hydrocarbon emissions from gasoline.

AIRBORNE PARTICLES

A retired professor's campaign against lorries belching oily black smoke as they climb a five-mile hill outside his home is worrying Britain's haulage operators. With a neighbour to make a double check, the professor took the numbers of 30 smoking lorries. Next day outside his house in Buxton, Derbyshire, he added 25 to his list in an hour. Then Professor Gunther Zuntz, former professor of Greek, reported the lorries to the police. The result: Buxton magistrates have had to hold special courts to deal with the professor's cases. Already they have dealt with 15 firms and six more prosecutions are in the pipeline. So far each of the offending 15 lorry owners has been fined £20, making the total fines £300.

A Road Haulage Association spokesman said yesterday: 'No one denies the professor's right to make complaints if he thinks fit. We agree smoking lorries are a problem but every responsible operator does his best to stop it.' The professor said: 'I heard the Environment Minister say the public should make use of the law to fight pollution. So I did.'
Daily Mail. 1.7.72.

Waging a private war against polluted air, is Vincent Summerton of Port Elizabeth, South Africa, who cycles to work each day wearing a miner's mask to filter motor exhaust fumes from the air he breathes. "I have always enjoyed cycling to work except for the awful smell of exhaust fumes," he said.
Gloucester Citizen. 13.7.72.

West Germany's Chancellor Willy Brandt was laughed at a few years ago when his Social Democratic Party campaigned for election with "Blue skies over the Ruhr", as a slogan. But nobody laughs anymore. Pollution is one of the dominant themes of politics in Germany today. A recent opinion poll conducted by a magazine revealed a higher degree of public interest in protection of the environment than in almost any other issue except peace. Nearly 70 per cent of the population, according to this poll, would contribute voluntarily to a special anti-pollution tax. Any politician today can expect instant applause if he mentions fresh air and clean water.
Bolton Evening News. 4.7.72.

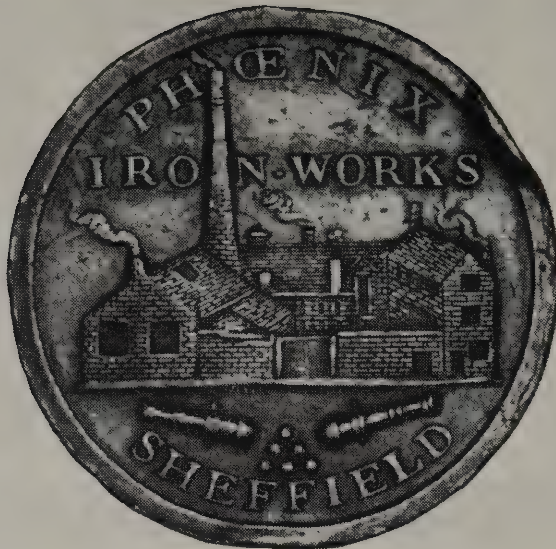
Atmospheric pollution, coupled with temperature inversion, is slowly killing off the trees on the Tokyo plain. Officials say that if nothing is done all vegetation will be wiped out within 50 years.
Medical News, London. 10.7.72.

Fuel and the Environment

HRH The Duke of Edinburgh, KG, KT, FRS, Hon M.Inst.F., has agreed to be Chairman of the Organizing Committee for a Conference on Fuel and the Environment held by The Institute of Fuel at the Congress Theatre, Eastbourne, from *27th to 29th November, 1973.*

Further details will be announced in due course.

Enquiries to Dr. R. Jackson, Conference Secretary. Telephone: 01-580 7124.


PHŒNIX
IRON WORKS
SHEFFIELD


PAYABLE AT SCORRIER HOUSE
ONE POUND
FOR
240 TOKENS
1812

BOOK REVIEWS

Advances in Environmental Science and Technology, Volume Two
Edited by James N. Pitts, Jr. and Robert L. Metcalf. Wiley-Interscience, New York/London/Sydney/Toronto. 1971. pp. 354. Price £8·50.
(Note: Volume One was reviewed in "Smokeless Air" Summer 1970. pp. 311-314)

All members of the National Society for Clean Air would find two-thirds of this second volume in the series of direct interest. The remainder deals with pollution from mercury, agricultural wastes, antibacterial drugs and the toxicity of food contaminants known as aflatoxins; subjects of special interest to our many Medical Officers of Health and Public Health Inspectors.

To give individual points of view, not mere summaries of the literature, the editors found seven experts, one each for the first seven chapters and two joint authors for the final eighth chapter. All chapters conclude with numbered references in a scientific manner. Although the 562 references are predominantly to American publications they include many references to British researches. The editors are respectively Professor of Chemistry at the University of California and Professor of Zoology at the University of Illinois.

The book opens with a chapter on *Air Pollution: Present and Future Threat to Man and His Environment"* by David L. Coffin of the Health Effects Research Division, Air Pollution Control Office, E.P.A., and Cincinnati University's School of Medicine.

The last chapter, *"Toxicity and Carcinogenicity of Aflatozins"* is based on the fact that some food-spoilage fungi are capable of producing toxic products, mycotoxins. The importance of this was known to those studying frequent outbreaks of poisoning in farm animals. Toxic agents were produced by common food-spoilage fungi. The potency of the aflatoxins as poisons among farm animals justified the considerable research in attempting to evaluate their importance to man. Whether they are a public health hazard is still uncertain.

It is a handy-sized, clearly printed book. The following comments are based on reading it carefully.

"Spectroscopic Methods for Air Pollution Measurement". Any study of air pollution must involve its observation and its qualitative and quantitative measurement. So it is good that the longest of these eight chapters deals with the role of spectroscopy in the study of atmospheres. The spectrum of the polluted atmosphere is much less well known that the spectrum of a clean atmosphere; yet it is clear that, from ultraviolet to infrared, the atmospheric absorption spectrum presents much information on the composition and physical properties of the atmosphere.

From the 124 pages and 75 references of this chapter, by Philip L. Hanst, of the Environmental Protection Agency, North Carolina, one gathers that the role of optics in air pollution analysis and monitoring will soon be much greater. Long-path absorption techniques, the laser absorption technique and nondispersive gas filter method deserve further application.

"Remote Sensing for Air Pollution Measurement", the chapter written by Herman Sievering of the University of Illinois, shows how a real need in air pollution research and forecasting may be met: continuous monitoring (night-time as well as day-time) in combination with vertical soundings.

With further improvements in lasers and use in mobile platforms (including satellites) the laser radar technique appears the best candidate for reliable, quantitative, spatial distribution, and real-time gaseous pollutant remote sensing.

Motor Vehicle Emissions are considered in the section written by John A. Maga, of the Air Resources Board, California. More than 100 million motor vehicles are now registered in the U.S.A. alone; twice as many as in 1950 when the case against them, as a major factor in community-wide air pollution, was first made. As well as their visible smoke, their odorous compounds, and carbon monoxide they were a cause of photochemical air pollution. Now we find that they have been proliferating twice as fast as people: because in no other age has so much power and freedom of movement been in the hands of the ordinary citizen.

From Maga's useful 34 pages and 19 references we may note that late in 1970 the California Air Resources Board adopted motor vehicle emission standards for hydrocarbons, carbon monoxide and oxides of nitrogen: and required a new test procedure for diesel powered vehicles. These new standards were expressed in grams per brake horsepower hour; and hydrocarbons and oxides of nitrogen were combined into one value.

There is, however, another form of air pollution from road vehicles not mentioned by Maga. Their amenity shattering, drumming, whining, throbbing noises spread far and wide. The apprenticeship of motor designers should include a spell of enforced quiet in a hospital near any main road.

Pollution by Mercury is the subject covered by J. M. Wood, of the University of Illinois, in his 18 page section with 50 references.

Lest we have on our consciences more people, like "The Mad Hatter" in Alice in Wonderland, let us recall that inorganic mercury, i.e. mercury metal or mercury salts, caused chronic mercurial poisoning among the London "Hatters", who user mercuric oxide to treat velvet fabrics. It also caused poisoning of dentists exposed to mercury vapour when mixing mercury-silver amalgams for fillings.

But now it has been found that mercury is converted to *deadly poisonous methylmercury* by micro-organisms. Moreover, methylmercury, used as a fungicide in agriculture, is beginning to accumulate in a number of foods.

Hence mercury pollution is partly intentional, for 3 per cent of the mercury used in the U.S.A. is distributed as methylmercury in agriculture: and partly unintentional. The latter must be controlled by checking the effluent wastes from industries daily. Quite recently industry has begun to offer agriculturalists seed dressings that are effective yet free from mercury.

Before we get too hot under the collar about agricultural wastes and environmental pollution, by pesticides, herbicides, insecticides and fungicides, we should remember that despite rapid increase in population agriculture has maintained abundance of food and fibre crops.

In 1910 a farmer produced food and fibre for seven people: in 1966 he produced it for forty-five people. In 1910 the U.S.A. housewife spent 40 per cent of the family income on food: in 1966 only 17 per cent. Gesse Lunin's chapter on this aspect of pollution is illuminating in showing how much has been done and must be done to make advances in agricultural production efficiency compatible with safeguarding our environment.

The chapter written by W. G. Haber, of the College of Veterinary Medicine, University of Illinois, on "*Antibacterial Drugs as Environmental Contaminants*" is of worldwide interest at the present time. The problems man has created in his environment with the injudicious uses of antibacterial drugs in animals can be greatly reduced. Even though some interested groups will lose markets and income if drugs are restricted, and non-efficacious uses are eliminated, many will appreciate the benefits of more efficient animal production and reduced public health problems.

Environmental problems are shown in panoramic views, as from map-makers triangulation stations, by the list of contents, and of sub-sections that preface the eight chapters of this book.

We naturally tend to devote our attention to reports and preprints of our pet subjects just as we watch the blackbirds and bluetits around our own few trees. Meanwhile the great forest stretches far and wide and huge eagles and buzzards soar in the clear skies.

The ever widening problems of civilised environment can be coped with easier because books like this map out the fields in which our work is needed.

T. Henry Turner

Reader Enquiry Service No. **7262**

Fundamentals of Industrial Ventilation. Third Enlarged Edition

V. V. Baturin. Pergamon, 1972. £12·00.

The title is apt. Mr. Baturin's treatise translated from the Russian deals in detail with theory; he adds a wealth of formulae and mathematical expressions.

The publisher's claim that the book caters for post graduate students is correct. I would doubt its usefulness to the practising heating and ventilating engineer as being too much confined to theory and seriously dispute its appeal in this country to trade union inspectors, technical or otherwise.

The designer of specialist dust extraction plant or those having the responsibility of designing air cooling systems for workers in foundries and steel mills will find much value, so will the Alkali and factory inspector. The appeal would be greater if the excellent diagrams and graphs were supplemented by photographs of actual installations using the principles so expertly set out and supported by test results of actual installations following commissioning of plant designed from the data given.

Conspicuously absent is any information on materials nor methods of construction.

Careful references are given to the author's sources of information, almost all in Russian, thus of very limited reference interest to the English speaking reader.

The short chapter on humidity deals with first principles and fails to refer to the universally used psychrometric tables and charts.

The author's treatment of air nozzles and inlet grilles—the calculation of natural air change in a variety of circumstances in addition to the chapter on air curtains will prove of value to readers.

The air douche method of protecting workers in hot environments is described in great detail and might well lead to substantial improvement in the many hit and miss cool air supplies provided in European works.

The student of pollution control will find much data on toxic materials and tolerable limits and the calculations of air quantity as well as the theoretical design of the air inlet grilles to achieve the optimum results.

Dust and cement dust extraction are expertly handled by the author and will materially assist those engaged in designing plant for abating the pollution problems associated with such plant.

The post graduate student can learn much from Mr. Baturin's development of mathematical expressions.

I finished my perusal of the book with a healthy respect for the erudite technical inspectors of central Committees of Russian trade unions.

F. M. H. Taylor

Reader Enquiry Service No. **7263**

The Environment This Month: The International Journal of Environmental Science

Volume One, Number One, July 1972. P.O. Box 55, St. Leonard's House, Lancaster, Lancs. Subscription: £18 per year.

This new journal contains articles and papers on current environmental problems. It also contains a monthly analysis of environmental news throughout the world, and reports on environmental damage; pollution; improvements that may have occurred; the misuse of resources and new products developed.

Reader Enquiry Service No. **7264**

Paint Technology and Air Pollution: A Survey and Economic Assessment

J. W. Spence and F. H. Haynie, National Environmental Research Centre. Environmental Protection Agency, U.S.A.

The purpose of this study is to provide the Environmental Protection Agency and other scientific and lay readers with technical information pertaining to the effects of air pollutants on exterior paints. The specific goals of this report are: (1) to survey the technical developments within the paint industry; (2) to identify the characteristics of pollutant attacks on exterior paints; and (3) to estimate the annual cost of pollution damage to these paints. This information will be used to set priorities in planning laboratory investigations and future contract studies on the effects of air pollutants on exterior paints.

The survey says that new paint formulations and new application techniques are emerging within the paint industry. Latex or water-base paints have captured substantially more than 50 per cent of the household painting market and are spilling over into the industrial market.

The chemical attack of certain air pollutants on exterior finishes is reviewed. An economic assessment was made of the chemical damage of air pollutants on four classes of exterior house paints. The total estimated cost at the consumer level is given.
Reader Enquiry Service No. **7265**

Air Pollution Control, Part II

Edited by Werner Strauss. 299 + xi pp. Wiley-Interscience, London, 1971.

This second part of a series of volumes on air pollution control, edited by Dr. Werner Strauss of the University of Melbourne, Australia, contains five articles or chapters. The first is an excellent and well-balanced article by Elmer Robinson and Robert C. Robbins of the Stanford Research Institute, California, on the emissions, concentrations, and fate of gaseous atmospheric pollutants. It covers compounds of sulphur and of nitrogen, carbon monoxide and carbon dioxide, and certain organic substances and considers not only man-made but also natural sources of these pollutants. In the second article, Annemaree Lanteri of the School of Law of the University of Melbourne gives brief statements on air pollution legislation in each of twenty-six countries in various parts of the world.

The control of airborne radioactive effluents from nuclear reactors is the subject of a useful article by G. W. Keilholtz and G. C. Battle of the Oak Ridge National Laboratory, Tennessee. The thermal deposition of aerosols is considered in the fourth article by James A. Gieseke of the Columbus, Ohio, Laboratories of the Battelle Institute. It is based on experimental results combined with theoretical analyses of the forces causing suspended particles in a warm gas to migrate to and be deposited on cooler surfaces. This method of separation of particulate matter has not so far been applied on a commercial scale. In the last chapter, Harold M. Englund, of the Air Pollution Control Association of Pittsburgh, gives a list of American resources of technical information and lists of books and other publications.

A. Parker

Reader Enquiry Service No. **7266**

The Influence of Yearly Weather Variations on Smoke and Sulphur Dioxide Pollution in Pretoria

Etel Kemeny and E. C. Halliday. Air Pollution Research Group, South Africa.

The report goes in detail into the problems of atmospheric pollution by smoke and sulphur dioxide in Pretoria. The annual and daily variations in the concentrations of smoke and sulphur dioxide in the atmosphere, which are mainly due to climatic factors, are discussed as well as the long-term trends which indicate that smoke levels have remained fairly constant at the two sites where they have been measured over periods of 13 and seven years respectively, whereas the levels of sulphur dioxide have decreased markedly.
Reader Enquiry Service No. **7267**

Statistics on Smoke and Sulphur Dioxide Pollution in South Africa

Etel Kemeny and E. C. Halliday. Air Pollution Research Group, South Africa.

Tables are given containing some data collected by the national survey on smoke and sulphur dioxide in South African cities and towns. The period covered is October 1969 to September 1970. Also published are statistical data which give information about the long-term trends at sampling sites in operation for at least three winter seasons.
Reader Enquiry Service No. **7268**

Electrical Association for Women 47th Annual Report 1971 and the Report of the Caroline Haslett Memorial Trust

1971 was a year in which the importance of the E.A.W.'s basic aim, which is electrical education, received greater and more widespread recognition than ever before. The value of E.A.W.'s work lies in the fact that it is carried out in both the formal and the informal education spheres. There was a marked increase in their work on the formal education side and discussions with educationalists pointed to the alignment of E.A.W. courses and examinations with the new thinking on education in this country.

Their Caroline Haslett Memorial Trust has had a year of great activity spurred on by the support and encouragement it received during its previous Silver Jubilee year. It is one of the few educational charities operating in scientific and technical areas whose awards are reserved for women.

As usual the E.A.W. took part in many exhibitions which gave them the opportunity to explain their activities to the public.
Reader Enquiry Service No. **7269**

Sulfur Dioxide Removal from Waste Gases

A. V. Slack. Noyes Data Corporation, New Jersey, U.S.A. 1971. $36.

Successful removal of sulphur dioxide from effluent gases is a very difficult task. This type of environmental pollution can be controlled and reduced to a minimum, but various factors, theoretical and practical, must be understood, before effective action can be taken. This book covers every aspect of sulphur dioxide generation and removal. Measures which can be applied by industry to prevent further contamination of the environment are also explained.
Reader Enquiry Service No. **7270**

The Israel National Committee on Biosphere and Environment. The Environment in Israel
2nd Edition, edited by Uri Marinov and Eitan Harel. Jerusalem, June, 1972.

The diversity of nature and man in such a small country makes Israel an interesting country scientifically but at the same time creates serious problems regarding the rational use of natural resources, environmental degradation and pollution. The combination of a diversified nature, a heterogeneous population of unequal density, rapid industrialization, and intensification of agriculture has made Israel's environmental problems most serious. Since the country is so small, the symptoms of environmental degradation are even more obviously visible and urgent than in larger and more developed countries.

The works of various Governmental and Research Institutes concerned with the environment in Israel are described and reports of committees on air pollution; water and marine pollution; soil pollution; pesticides; noise pollution; solid waste disposal and regional and urban planning are given. Chapters on environmental education and environmental legislation in Israel are also given.

Altogether a very clear and concise account of what Israel is doing to solve environmental problems.

Reader Enquiry Service No. **7271**

Nitrogen Oxides Emission Control
A. A. Lawrence. Noyes Data Corporation, New Jersey, U.S.A., 1972. $36.

The detailed, descriptive information in this book is based on U.S. patents since 1950 relating to the control of nitrogen oxide emissions of all types. The book serves a double purpose in that it supplies detailed technical information and can be used as a guide to the U.S. patent literature in this field—literature which covers a substantial amount of information not available in the journal literature.

The bulk of the processes covered are concerned with controlling the emission of nitrogen oxides in the flue gases of chemical plants involved in chemical nitrations or the manufacture of nitric acid. Processes for reduction or removal of nitrogen oxides from exhaust fumes and coke oven gas are also described.

Reader Enquiry Service No. **7272**

Guide to the Reduction of Smoke and Odour from Diesel-powered Vehicles
U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, North Carolina. September, 1971. 30 cents.

These guidelines are the result of a detailed study of technical literature and reports dealing with diesel smoke and odour and of interviews with engine and vehicle manufacturers, fuel and additive suppliers, fleet operators and enforcement agencies. The guide discusses the general characteristics of diesels, ways to reduce smoke, and ways to reduce odour, each in separate sections.

Reader Enquiry Service No. **7273**

The Calibration of Optical Density Instruments in Ringelmann Numbers

The British Standards Institution has published an important addendum to BS 2742: 1969 Notes on the use of Ringelmann and miniature smoke charts. This is Addendum No. 1 (1972) The calibration of instruments in Ringelmann numbers.

Since the adoption of the Ringelmann scale for the visual estimation of smoke density, other means of measuring smoke emission have been employed, in particular the determination of optical density before the smoke leaves the chimney.

Information has been collected which now appears to justify the acceptance of a basis of calculation which permits the conversion of such optical density readings to equivalent Ringelmann numbers and Addendum No. 1 to BS 2742 has been issued in order to regularize this conversion.

Account is taken of the effect of changes in the proportion of smoke at the exit from the chimney and also of the change in temperature, so that the result obtained corresponds as nearly as is practicable with that which would be observed by using a Ringelmann chart.

Reader Enquiry Service No. **7274**

New additions to the National Soiecty for Clean Air Library, available on loan

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Lawrence, A. A. Nitrogen Oxides Emission Control. Noyes Data Corporation, New Jersey, U.S.A. 1972.

Israel National Committee on Biosphere and Environment. The Environment in Israel. 2nd Edition, edited by Uri Marinov and Eitan Harel. Jerusalem, 1972.

"Air Knows No Frontiers"

INTERNATIONAL NEWS

Summary of the United Nations Conference on the Human Environment, Stockholm, 5-16 June, 1972

The results of two weeks of work at the United Nations Conference on the Human Environment are set out in three documents: recommendations for an Action Plan to tackle the planet's environmental problems; a resolution outlining a scheme for new United Nations machinery including an Environmental Fund to focus international efforts on these problems; and a Declaration on the Human Environment containing the principles which the nations assembled at Stockholm believe should guide them in the years ahead.

The 106 recommendations approved by the Conference will go into the Action Plan that sets out tasks and guidelines for Governments and international organizations. The following are some of the more specific recommendations:

(1) A world-wide network of at least 110 atmospheric monitoring stations should be established to keep watch on changes that might lead to climate modification; the release of toxic substances such as heavy metals (including mercury) and organochlorides (such as DDT) should be minimized.

(2) More money should be made available internationally to improve housing, water supply, transport and other essential services, notably through the creation of a special fund.

(3) Governments should agree not to invoke concern for the environment as a pretext for discriminating against certain countries in their trade policies; where environmental concerns lead to trade restrictions, compensation should be arranged for the countries affected.

(4) An International Referral Service should be established to link institutions or persons in one country who wished specific information about the environment with those elsewhere who could provide such data.

(5) To ensure continuing international action on the environment after the 1,200 delegates from 110 nations left Stockholm, the Conference recommended to the General Assembly the creation of new United Nations machinery. This would consist of a 54-nation Governing Council for Environmental Programmes, a voluntary Environmental Fund to finance those programmes, a small secretariat to carry on the day-to-day work, and procedures to co-ordinate the manifold activities of United Nations agencies concerned with the environment.

To "inspire and guide the peoples of the world in the preservation and enhancement of the human environment," the Conference adopted a Declaration on the Human Environment. Its 26 principles begin with the notion that man has a right to an environment of quality and a responsibility to protect and improve the environment for future generations.

The Declaration, which is the first international political consensus on principles for preserving and enhancing the habitat of man, was adopted by acclamation at the closing meeting of the Conference. A draft had been drawn up for over two years by an Intergovernmental Working Group of the Preparatory Committee for the Conference. The Conference set up another Working Group, composed of all States present at Stockholm, for further discussion of the draft.

In its preamble, the Declaration states that a point has been reached in history when "we must shape our actions throughout the world with a more prudent care for their environmental consequences".

The principle concerning State responsibility reads: "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction".

As to pollution, the Declaration states that the discharge of toxic or other substances and the release of heat in quantities beyond what the environment can render harmless must be halted to prevent serious or irreversible damage to ecosystems.

The Conference expressed its concern about radioactive pollution by adopting in a plenary session a resolution condemning "nuclear weapons tests, especially those carried out in the atmosphere". It called on States intending to carry out such tests to refrain from doing so, "as they may lead to further contamination of the environment".

To help focus public attention on the problems of the environment, the Conference unanimously recommended that a World Environmental Day be marked on 5 June each year.

The Conference, on the issue of education, information, social and cultural aspects of environmental issues, recommended action in three main fields: education and training of specialists; measures to arouse public support to protect the environment; and conservation of the world's resources.

A variety of international measures to check the rising level of contaminants in air, water, food, the oceans and the human body itself are set out in the recommendations of the Conference on pollutants of international significance.

On the general problem of pollution control, the Conference asked Governments to act in concert with one another and with international organizations in planning and carrying out control programmes for pollutants which cross national boundaries. It suggested that the United Nations review and co-ordinate this co-operation and encourage the establishment of mechanisms through which States could consult on the speedy implementation of concerted abatement programmes.

A number of steps were recommended to gather and assess the information man needs about pollutants in the environment if he was to exercise effective control over them. The Conference proposed an increase in the capability of the United Nations system "to provide awareness and advance warnings of deleterious effects to human health and well-being from man-made pollutants". The stated aim was to provide such information in a form useful to national policy makers. The Secretary-General was asked to help Governments that wished to use such data in their national planning.

It was recommended that the United Nations work out a procedure for identifying pollutants of international significance and consider appointing expert bodies to assess the exposures, risks, pathways and sources of such pollutants.

The Conference also adopted recommendations on specific kinds of pollution. On health effects, it recommended a major effort to develop monitoring and research that would make possible the "early warning and prevention" of the deleterious effects of pollutants. The WHO was asked to help Governments monitor air and water in areas where health might be threatened, to establish environmental health protection standards, and to co-ordinate an international system to correlate medical, environmental and family-history data.

The climatic effects of pollution were dealt with in a recommendation that a network of at least 100 stations be set up to monitor the atmosphere, together with another 10 stations in remote areas to monitor long-term atmospheric trends which might cause meteorological changes. Governments were asked to be mindful of activities that might affect climate, carefully evaluate the likelihood and magnitude of such effects, disseminate their findings in advance, and consult other States when they contemplated or engaged in such activities.

Finally, the Conference recommended that the General Assembly review the whole environmental machinery in 1976.

CANADA

With their huge territory and small population, Canadians believe that they enjoy the cleanest physical environment among the world's industrialised nations. But they have suddenly been warned by the independent Science Council of Canada that their land is being misused and their air and water polluted on a dangerous scale. In a startling report entitled "It Is Not Too Late—Yet" the council says that while Canada has the money and knowledge to save its affluent estate, it has no time to lose. Before they can master the problems of pollution, the council adds, the Canadian people must abandon the "almost euphoric" notion that increasingly rapid economic growth will "solve all evils".

AUSTRALIA

Australian cars are up to five years behind similar American vehicles in pollution control techniques, according to an American expert. The emission programme manager for Ford in the United States, Mr. Paul McKee, said in Sydney that Australian cars were " up to the U.S. 1967 models, but not as good as the 1968 ones ", in combating pollution. American cars already had controls that would not be necessary in Australia until 1974, he said.

JAPAN

Japanese drivers may soon have personal traffic control data available in their cars in an effort to beat road jams. The Transport Ministry has drawn up plans to develop a computerised " traffic guidance system " as part of a drive to reduce accidents, congestion and air pollution from exhaust gases. Under the scheme, radio receivers will be installed in vehicles to relay last minute information from a main computer to the driver about road conditions ahead of him. The Ministry plans to start the development in 1973 and will stage the first experimental campaigns within four years at a cost of up to £625,000.

NEW ZEALAND

The Vice-Chancellor of Auckland University, Dr. C. J. Maiden, has said that within a year or two there could be set standards on the amount of exhaust emission allowed from cars in New Zealand. Dr. Maiden said that they should be setting emission standards on new vehicles. It was better he felt that they did it now rather than wait until they had to. It would be no great problem for the makers of cars brought into New Zealand to meet such standards, since they were already having to meet tighter and tighter standards in the United States.

DENMARK

A/S Kosangas International, is co-operation with the Laboratory for Energy Technology who are situated at the Danish Technical University, have developed a purification system for gas exhaust fumes which will be able to contribute considerably to the reduction of outlets of unwanted gases and lead. The system consists of a reducing catalytic reactor combined with a thermal reactor. It has been developed by Knut and Leif Jensen and was recently demonstrated on a Ford Cortina 1300 engine. The results were as follows: Carbon monoxide was reduced by 90 per cent; the content of non-combusted hydrocarbonates was reduced by more than 90 per cent; nitrogen oxide by about 80 per cent; and the content of lead was reduced by about 40 per cent. Amongst other things, the Catalytic-Thermal Reactor makes the silencer superfluous.

Letters to the Editor

The Editor,
Clean Air
Sir,

Thank you for your courtesy in drawing our attention to the contents of the letter which you have received from Captain Douthwaite of the Sully Residents and Civic Trust Association.

It is particularly distressing to us that allegations of bad faith and of the contemptuous treatment of complaints should be put forward by someone who is very well aware of the steps taken by BP Chemicals Barry factory "to ensure that the Environment suffers as little as possible". Some of these steps are:

In 1970 the Barry factory carried out a pollution audit on each plant on the site which resulted in detailed remedial measures being taken.

A new job of shift manager was specifically created. Their responsibility is to take daily noise measurements at points outside the factory and to make a daily tour of the perimeter to record any detectable odours. The factory management then takes immediate action whenever it becomes necessary and the information is also passed on to the Public Health Inspector and to all the Alkali Inspectorate. Complaints received at any hour of the day or night are passed to the shift manager who visits the complainant's area immediately, makes a plant inspection and completes a complaint report for management action.

A Pollution Control Committee has been set up to monitor progress in tackling problem areas and to ensure maintenance of the improved standards already achieved.

Money spent is another indication of a serious desire to solve the problem. In addition to pollution control measures built into the plants, in recent years we have also spent some £340,000 on further equipment. Of this, nearly £250,000 has been devoted to the odour problem, which accounted for a little over 80% of the complaints received.

Odour is in some ways the most difficult of all problems to deal with because it is so subjective and indefinable. For example an examination of the daily checks shows that over the past six months shift managers recorded an identifiable smell on only three occasions on their tours of the factory perimeter. This compares with eight complaints of smell in the same period, of which only four could be positively identified as coming from the factory.

Our principal yardstick for measuring the effect of the various actions we have taken must be the analysis of complaints received. During the past two years these have shown a marked reduction of complaints—from 142 in 1970 to 47 in 1971. A comparison of the figures for the first quarter of 1971 with the first quarter of 1972 indicates even fewer complaints—the relevant figures being 11 in 1971 and eight in 1972. The action we have taken to prevent and reduce noise has also been successful. In 1970 40 complaints about noise were received, but only two in 1971.

Barry factory, which employs some 2,000 people, was established in 1948 in an industrial development area. The factory is now flanked with houses, most of which have been built since it was completed. BP acquired the factory in the late 1960's as part of a larger purchase.

We fully understand the desire of local residents to enjoy the highest environmental standards. From the above it is clear that important steps *have* been taken to ensure that the environment suffers as little as possible from our operations. There are absolutely no grounds for the charge that complaints are treated with "contempt" by the Barry factory management. It is equally untrue that the factory discharges waste indiscriminately.

Yours faithfully,
FYFE GILLIES,
Manager, Environmental Control Centre

The British Petroleum Company Ltd,
Britannic House,
Moor Lane,
London.

The Editor,
Clean Air
Sir,

The Future Control of Atmospheric Pollution

Except for the questions of boundary alterations and demotions of County Boroughs, the proposals for reorganisation of Local Government have raised so little discussion that it would appear the public remains apathetic. There is, however, one field in which the National Society for Clean Air is vitally interested and, if not dealt with correctly now, may—I fear—lead to serious disillusion with the abilities of Local Governments to do anything effective.

In the original proposals for the reform, now under consideration, the Minister for the Environment laid the responsibility for this control with the upper tier authorities and I have yet to find anybody with knowledge of the problem, who does not think that this was a wise choice. However, it seems that under pressure from Local Government Associations, whose members

will become second tier authorities, the Minister has given way and now places responsibility with this tier. I have never seen any publication of the reasoning for this change, but gather that the view of the associations is that, as this work has been done by their members in the past, it should continue thus. This, if correct, does not seem to be a very good basis for the change.

Satisfactory future control surely depends on having available a suitable number of properly trained and qualified persons to cope with the problems that will arise. Since the Alkali Inspectorate operate with, I understand, 37 scientifically qualified staff, it appears highly unlikely that 380 will be necessary to deal with the problems that will in future fall within the responsibility of Local Governments. Sixty, the number of the Upper Tier—County and Metropolitan areas—seems a more likely figure but, allowing for the possibility that even initially the Metropolitan Areas may require more than one person, a requirement in excess of 100 seems improbable. Therefore, for each and every future District Authority to engage an adequately qualified person or to train one to an acceptable standard would not only be a waste of resources but would probably lead to frustration when they found their abilities underused.

Two solutions appear possible; the first and most satisfactory that those Associations, which pressed the Government to place the responsibilities with the lower tier, rethink the matter and, then, one hopes, admit that the Government's original ideas were correct. If, on the other hand, they are not prepared to do this, then an alternative solution would be for the lower tier authorities within a future County or Metropolitan Area to group together—as now for Medical Officers of Health —and engage jointly a very well qualified person.

As certain types of Atmospheric Pollution call for expertise, which is at present only in course of development, quick interchange of information is essential—a much simpler problem if only 60 authorities are involved. It should also simplify exchange of information with the Alkali Inspectorate.

Still, whatever arrangements are adopted, it is likely that the staff of the Public Health Inspectorate will be involved from time to time when nuisances arise. That an increasing number of entrants to the profession are taking advantage of the sandwich courses at Aston and Salford Universities is a step in the right direction but all future entrants to the service should be aware of the broader aspects of the problem and a widening of the curricula and examinations to cover this field is essential. It would be encouraging to hear that early provision for this will be made.

It must be hoped, too, that in future there will be better liaison between Local Government Departments to ensure that any new developments involving processes that will give rise to pollution are suitably sited and also that the Planning Consents are issued with the necessary appropriate conditions. It has been said that one cannot anticipate a nuisance but this surely is not only a complete negation of planning but may also be a waste of resources in that remedial works, which would otherwise have been avoided, become necessary.

One final hope—that any new Legislation in the field will make it clear that the defence provided under Section 94(5) of the Public Health Act 1936 is not an absolute defence as appears to have been thought so far. The very best equipment is useless unless it is properly operated and maintained.

I regret the length of this letter but, as the matter is of importance, trust that you will be able to find space for it in your columns.

Yours faithfully,

E. R. WATKINS.

The Coach House,
Chardstock,
Axminster,
Devon.

The Editor,
Clean Air
Sir,

Pollution from Road Vehicles
(Clean Air—Spring 1972)

May I refer to the above article and in particular to a remark attributed to Professor P. J. Lawther:

"He pointed out that the measured concentrations of pollution in Fleet Street and other areas of London, were very much less than those in cigarette smoke. . ."

Since cigarette smoking is acknowledged by most informed people to constitute a serious health hazard, the above comment can do little to allay the fears of people exposed to this lesser degree of pollution. However, if the remark is intended to imply that there is less health risk to a non-smoker in these areas than to a smoker in a non-polluted area, I would make the following comments from my own observations.

I inhale approximately fifteen times per minute which gives a total number of inhalations daily of 21,600. I smoke approximately 20 cigarettes a day each of which gives an average number of inhalations of 25. However, in drawing the smoke from my mouth to my lungs, I dilute it to approximately one tenth concentration. Consequently, the total number of concentrated smoke inhalations in the course of a day is 50 against a total air consumption of 21,600.

If, therefore, I may reinterpret the above quotation, I would say that: If the measured concentrations of pollution in Fleet Street and other areas of London are only 1/432 part of those present in cigarette smoke, a non-smoker is exposed to as great a health risk as a smoker in an un-polluted area.

The above figures are "armchair measurements" not scientifically calculated, but more accurate experiments on these lines might well prove to be interesting.

From a practical point of view, I would comment that I smoke cigarettes but live in a Wiltshire village. After only twelve hours spent in London on a business trip, I am always aware of some discomfort in my throat and lungs.

Yours faithfully,

B. H. EDWICK.

F. E. Beaumont Ltd,
Mere, Warminster,
Wilts.

The Editor,
Clean Air
Sir,

I was very pleased to read the encouraging review of my book "This Dirty World" in your Spring 1972 issue. I feel, however, that I must comment on your reviewer's remarks about my 'rather muddled' facts of the Clean Air Acts.

I have stated that the 1956 Clean Air Act permitted the emission of smoke from industrial premises for set periods of time. My facts are *not* muddled, but a concise statement of what is permitted as a result of "The Dark Smoke (Permitted Periods) Regulations, 1958" issued by the, then, Minister of Housing and Local Government exercising his powers under subsection (2) of section 1 of the Clean Air Act, 1956. These regulations apply equally to the 1968 Act.

My interpretation of this is based upon "Clean Air—Law and Practice", by Garner and Crow, 3rd edn., pub. Shaw and Shaw (1969). I would refer you particularly to pages 24, 228 and 229 of this publication which make it quite clear that black smoke may be emitted "for certain well-defined periods" as I have stated in my book.

I trust this clarifies the point adequately.

I apologise for not having your new address in the appendix to the book, but I believe your move occurred after it was written. I am arranging to have this changed in the second printing in the near future.

Yours faithfully,
RONALD C. DENNEY

Lake View Road,
Sevenoaks,
Kent.

Winston Churchill Memorial Trust

The aim of the Trust is to create the following opportunities. To give men and women from all walks of life the chance to increase their knowledge by travel abroad. And to use what they learn for the progress of their country.

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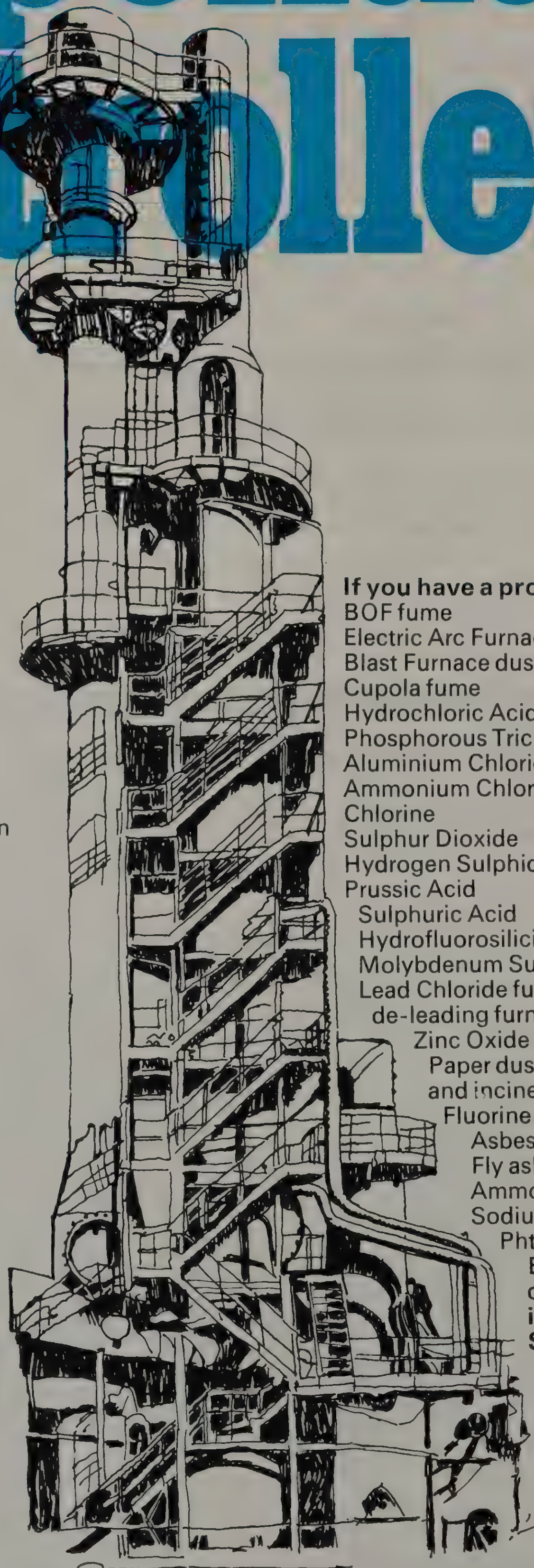
To obtain an application form, send your name and address only on a postcard to: Winston Churchill Memorial Trust, 10 Queen Street, Mayfair, London W1X 7PD. Completed application forms must be returned before 6th November 1972.

the pollution controllers:



Newton Chambers Engineering, in collaboration with Gottfied Bischoff K.G. of Essen, offer fume cleaning plants for steelworks duty – specially developed for the efficient removal of dust and fume from oxygen blown steel furnaces.
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Molybdenum Sulphide
Lead Chloride fumes from de-leading furnace
Zinc Oxide furnace fumes
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Fluorine gas
Asbestos dust
Fly ash
Ammonia
Sodium Perborate
Phthalic Anhydride
Boron Trifluoride
or similar,
it's not one to be sniffed at.
So try us for the answer.
For full information concerning this and other equipment, please write for data sheets 6.10, 6.11, 6.12, 6.16.

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Please send technical literature:

Name ______________________

Company ______________________

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CAI.

Reader Enquiry Service No. 7279

INDUSTRIAL NEWS

Gas Tight Isolation—An Increasing Contributor Towards Clean Air

by G. Crossgrove, Metro-Flex Group of Companies

The Metro-Flex Group reports an increasing awareness by plant operators and plant designers alike, of the need for really effective isolating valves and dampers in their waste gas cleaning plant layouts.

In recent years, a number of United Kingdom Power Stations, Cement Works, Refuse Incinerators and Steelworks with multiple electrostatic precipitators have been so designed that these units are cross-connected at their inlets and fitted with valves to enable individual precipitators to be shut down while the remainder of the plant continues on load.

This facility has, in some instances, prompted the introduction of planned maintenance for precipitators which was hitherto impossible. Now it is a simple matter to isolate a precipitator and carry out internal inspection, snip out damaged electrodes, or clear bridging faults, without danger or the need for breathing apparatus. The precipitator is thus maintained at a high operating efficiency with no complaints from the pollution control authority and no loss of production due to forced outages.

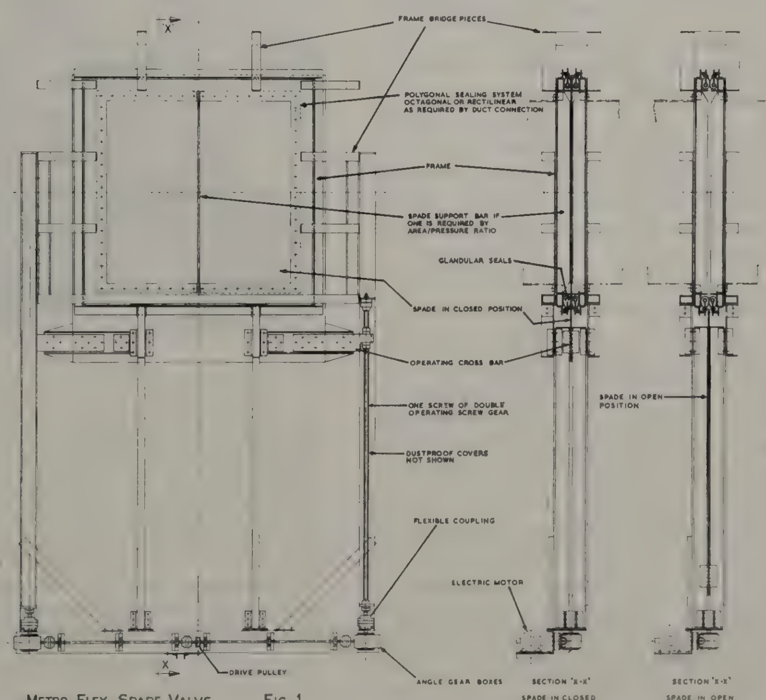
Many existing plants now responsible for quite heavy pollution of the atmosphere could be provided with this facility at a relatively low cost. In fact, many plants already have their precipitators inter-connected but find that their old-fashioned butterfly valves or multiblade dampers are so ineffective as to be useless. In such cases, the cleaning efficiency invariably deteriorates to a point far below the accepted level of atmospheric pollution, ultimately calling for a complete outage of the entire plant and an ensuing loss of production.

The Metro-Flex Group markets and installs a range of some 10 types of gas-tight valve for different operating conditions. Their latest addition to this range is the Spade Valve, fig 1, which has now been proved by more than two years of operation in severe conditions. This valve is a development of the old-fashioned "blanking place" so often used in the past for absolute isolation against toxic fume. Instead of the old concept of a flanged joint with gaskets and a multitude of nuts and bolts, the Metro-Flex Spade Valve has a flexible joint consisting of two complete looped seals in austenitic stainless steel, through which the spade is driven by a motorised drive. In the shut position the spade extends beyond the sealing system on all sides thereby constituting a positive barrier in the flue or duct. In the open position the spade is completely withdrawn from the sealing system thereby presenting absolutely no restriction to normal gas flow.

"Blanking plates" are notoriously time and labour consuming in the fitting and removal operations which can, of course, be rather costly in lost production. The Spade Valve, on the other hand, requires only one to three minutes to operate either way at the touch of a push-button, depending on the size of the unit.

High dust burdens and the resultant accumulation in the duct presents no problem to the Spade Valve which merely slices its way through the accumulation as it moves to the closed position. On withdrawal, the spade is automatically cleaned as it passes through the seals and out into the atmosphere.

The spade can be arranged for entry from the top, side or bottom depending on the amount of space available round the duct. Where the gases are corrosive, as with some oil-fired appliances, the sealing system



METRO-FLEX SPADE VALVE. FIG. 1

is fabricated in titanium sheet whereas, for high temperature effluents, Nimonic alloys are used.

A good deal of effort and expense has already been expended by many individuals in the drive for cleaner air, but a visit into almost any industrial area in the country today reveals only too "clearly" that much yet remains to be done. On-load maintenance of dust removal plant whether it consists of electrostatic precipitators, bag-filters, or wet scrubbers, is essential if we are ever to rid the atmosphere of solid matter.

Reader Enquiry Service No. **7280**

Conversion to Natural Gas

Britain's programme of conversion to natural gas completed its halfway stage on the 21st July when the home of a London policeman switched to the new gas. The home was scheduled as conversion number 6,758,171 in the nationwide programme.

The conversion programme, which started in Burton-upon-Trent in the summer of 1967 following a pilot exercise in Canvey Island the previous year, will be completed by March 1977. It is the most complex and intensive operation of its kind ever carried out in the world, involving over 40 million appliances and more than 150 million burners, controls and fittings. This year over 2,310,000 conversions are scheduled.

Philblack Limited Steps up Anti-Pollution Drive

Philblack Limited, of Avonmouth, Bristol—one of Europe's leading manufacturers of carbon black—is among the first companies in Britain to set up an environmental pollution monitoring system based on a newly-developed deposit gauge for measuring atmospheric "fall-out".

It is hoped that it will prove a major weapon in the Company's campaign to tighten up detection and control procedures for airborne contamination.

The manufactuirng process for carbon black—a finely-dispersed, high-purity carbon which is a vital raw material in the rubber industry—can produce soot-like emissions which, although not toxic or corrosive, are nevertheless dirty and unsightly.

In the past, Philblack Limited has monitored "fall-out" from these emissions, in the areas surrounding its plant, by means of conventional British Standard dust guages, which suffer the disadvantage of being non-directional in effect.

Now, the company has acquired supplies of a completely new type of dust-gauge, specially developed by the Central Electricity Research Laboratories, which is shortly to be adopted as the new British Standard for this type of instrument.

A number of gauges are being installed downwind of the Avonmouth plant, each one sited a measured distance from its nearest upwind neighbour. Since a major design feature of the new gauge is its ability to measure "fall-out" arriving from a given direction, it is hoped that it will provide Philblack Limited with a greatly-improved method of determining the degree and extent of current pollution problems.

By instituting a system of careful and frequent checks on each monitor, the company will also be able to relate "peaks" and "troughs" in emission levels to the various cycles of plant operation, and to develop control procedures aimed at minimising such occurences.

The new CERL gauge consists of four slender, cylindrically-shaped plastic tubes, with longitudinal apertures, mounted vertically and at right angles to each other around a central support. Dust, pollution and other atmospheric debris enters the aperture of the upwind-facing tube and is collected in a sealed container at the foot of the apparatus.

The provision of four independent dust-collecting devices, each orientated towards a different compass point, allows pollution arising from any specific source to be identified and measured with appreciably greater accuracy than was hitherto possible.

In conjunction with the new "fall-out" measurement system, Philblack Limited is also taking steps to improve source monitoring of accidental emissions from its plant.

To deal with this aspect of the problem, the Company is installing a flue-dust monitor—another newly-developed instrument designed by CERL—which will give a continuous check on emission levels from the complex flue system connected to the furnace reactors, where oil is burnt to produce carbon black.

This instrument is expected to provide a valuable means of checking plant operating efficiency (and of signalling the need for adjustments if emission levels rise unexpectedly) and will also make possible, for the first time, the definition of acceptable standards in the plant.

Reader Enquiry Service No. **7281**

Pathfinder Introduce Flammability Tester

A new product which is part of a range of environmental safety equipment has been introduced by W. H. S. Pathfinder Ltd, of Havant. It is a Flammability Tester—a portable instrument which can test the flammability of a wide range of materials such as plastics, rubbers, printed circuit panels and any mounting surfaces likely to be used in high temperature environments. The design of the Tester originated from the Belling & Lee environmental test house.

Based upon a specification from the German DIN series the Flammability Tester has been developed to offer consistent and repeatable test results. Conditions can be varied to meet many different test specifications and individual requirements.

The Tester is constructed for bench top operation, and test samples are clamped firmly into position and brought into contact with a glowing mandrel; pressure of application, temperature, and period of contact can all be accurately controlled. The Tester also has facilities for measuring or gauging the depth of penetration by the hot mandrel and the height of any resultant flames. Ignition times and burning times can be checked as well as identification of self-extinguishing, explosive or fume-creative characteristics. It is also possible to effectively simulate low, medium and high overloading of power dissipating components and connecting wires. Both endothermic and exothermic reactions can be identified.

As well as the obvious advantages to the electronic component industry, Pathfinder's new Flammability Tester can be used to monitor materials and finishes used in fields as diverse as the automotive industry, medical/chemical engineering, underground mining and scientific research.

Reader Enquiry Service No. **7282**

New Test Rig Aids Anti-Pollution Experiments

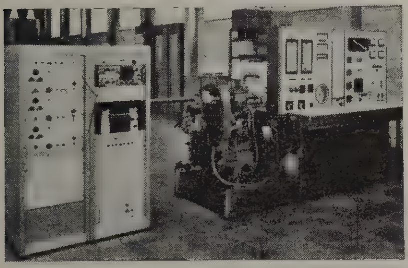
Tecquipment Limited of Nottingham, have designed and built a new test rig for the Hitachi Electronics Company of Japan to study the effects of exhaust emission from petrol and diesel engines.

Known as the Varimax, the test rig was originally designed for teaching engineering students the theory and practice of petrol and diesel engines.

Now, the Japanese experiments and the world wide interest in controlling pollution from motor vehicles, has greatly widened the scope of the test-rig and will take the Varimax out of the classroom and into the research laboratories of a wide range of industrial and scientific organisations all over the world.

Basically, the Varimax test rig comprises a single cylinder petrol/diesel variable compression engine with an electronic console to provide visual and recorded diagrams of all experiments.

As a special feature, the cylinder head of the engine will be fitted with a removable optical quartz window for observation of combustion within the engine cylinder.



The Varimax has all the features that allow the study of compression ratio, valve and ignition timing, fuel characteristics and many other variables that could affect the exhaust gases of petrol and diesel engines.

Whilst the engine is running the crankshaft assembly may be raised or lowered to alter the compression ratio between 4·5:1 and 20:1. The engine may be operated at a four stroke spark ignition engine or as a compression ignition unit. Valve timings can be advanced or retarded, the duration of valve openings altered and the main carburrettor jet adjusted to vary the fuel/air ratio.

With the engine stationary, various choke sizes may be fitted to the carburettor and the flywheel mass may be varied by the addition or removal of inertia rings.

These and other parameters can be varied at will and make the Varimax a natural choice for a wide range of experimental research work concerned with reciprocating internal combustion engines.

Another important feature allows the main bearing loads to be readily computed and checked. Strain gauges on the vertical and horizontal crankshaft supports enable the actual load on the engine crankshaft to be measured under all running conditions.

The Varimax is supplied as a complete fully integrated test rig with all equipment, instrumentation and electronic equipment for viewing and recording diagrams of cylinder pressure, diesel fuel line pressure, injector needle lift, inlet and exhaust pressures and cyclic variations of the angular velocity of the flywheel.

Reader Enquiry Service No. **7283**

John Zink Packaged Incinerator

John Zink Company, already the world's largest burner manufacturer and a major supplier of pollution control equipment, has now introduced a range of compact solid waste incinerators.

The new Z.E. incinerator's flexible combustion system ensures the efficient disposal of most industrial wastes including plastics, and is designed for use by industry, hospitals, schools, hotels and institutions.

Combustion is smokeless, odourless and produces no fly ash. Air pollution is consequently reduced to the minimum, enabling the requirements of the Clean Air Act to be met without additional auxiliary equipment.

Simple to operate, the burning sequence is automatically controlled and the unit shuts down when a cycle is complete. Attention is limited to daily ash removal, half-hourly recharging as necessary and to press button initiation of the next cycle.

Most of the dangers associated with conventional multi-chamber incinerators are eliminated. When burning is complete waste is fed into a cool chamber avoiding possible harm to personnel from blowbacks, etc. Safety interlocks and the fact that the incinerator is completely sealed in operation overcomes further sources of potential injury linked with conventional incinerators.

Z.E. incinerators can be installed out of doors without further protection, or inside a building where the smokeless, odourless, fly ash-free system of sealed combustion renders it both safe and clean.

They are manufactured in dimensions from 6ft × 4ft to 12ft × 8ft and weigh between 3½ tons and 12 tons. The range of waste disposal is from 125 lb/h to 1,000 lb/h.

The automatic burners can be fired by town gas, natural gas, L.P. gas and 35 second fuel oil. The after burner stays in operation throughout the cycle, whereas the ignition burner is extinguished when ignition is established. Gas governors or oil pumps are incorporated together with integral fans and safety controls. All controls and indicator lights for the automatic sequence are positioned in a weather proof control panel.

Z.E. incinerators are manufactured from welded mild steel plates suitably stiffened and lined with a high quality monolithic refractory anchored to the steel plate. The stack is constructed from refractory-lined mild steel and has a stainless steel mesh spark arrestor.

Reader Enquiry Service No. **7284**

New Instrument Measures Hydrocarbons in Pollution Studies

The determination of the hydrocarbon content of gases, particularly necessary in the study of motor vehicle exhausts, is the principle function of the Hartmann & Braun Fidas gas analyser which operates on the flame ionisation principle.

In this type of analyser the sample gas containing the hydrocarbons is fed to a hydrogen flame in which the hydrocarbons are ionised. The ion current in the flame is proportional to the carbon concentration when paraffinic hydrocarbons are the source of the current and ranges between 10^{-10}A and 3×10^{-8}A. It is amplified into a 0 20 mA output signal.

The complete Fidas analysis is contained in two interdependent cases which are associated in their function. One case houses the analysis section, including the air supply, detector block, amplifier and indicator. The second case accommodates the supply pumps and hydrogen control unit.

Measuring ranges are available which correspond to hexane (C_6H_{14}) concentrations from 0-1 ppm up to 30,000 ppm.

New Black Allplas Balls

The existing range of Allplas hollow plastics balls has been augmented by a new product to be known as Allplas Black.

The use of plastics balls as floating 'blankets' on open process tanks, introduced some years ago by Capricorn Industrial Services Ltd. as the Allplas system, has been adopted by many industries to reduce heat losses, to prevent evaporation, to eliminate smells, freezing, splashing, oxidation and for many other indoor uses.

Fig. 1.

The new ball (see Fig. 1) is made of low-density polythene with a 2·5 per cent admixture of carbon black and is intended for outdoor use. The carbon renders the material resistant to the ultra-violet component in daylight. Allplas Black balls should have a service life of up to 10 years under tropical sunshine and of at least 20 years in temperate climatic areas.

Like the well-known unpigmented (translucent white) balls made of polypropylene, the new type of ball is blow-moulded in one part, without seam or join. The patented integral circumferential rim, which prevents rotation of the floating balls, has been retained because when floating balls rotate they act as evaporators and make matters worse instead of better.

The new ball has been developed to meet the growing demand for a means of eliminating smells from cesspools, settling tanks and lagoons, digesters, collecting pits and similar outdoor installations. One size only of 45 mm. ($1\frac{3}{4}$ in.) diameter is available, in minimum quantities of 100,000, sufficient to form a single-layer blanket of 2,000 ft.^{2} (184 m^2) area.

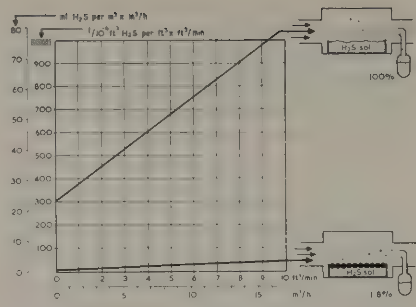


Fig. 2.

Virtually indestructible and incurring no installation, maintenance or operating costs, a single Allplas layer has a proven ability to reduce by 98·2 per cent the smell emanating from any liquid (see Fig. 2). At a time when atmospheric pollution is receiving so much attention, this new remedy will no doubt be most welcome. In addition, ball blankets virtually eliminate algal growth, considerably reduce the rate of oxidation of liquids and drastically reduce heat loss and evaporation from liquids without hampering access.

Reader Enquiry Service No. **7285**

Solving Pollution Problems at Fertilizer Plants

In the manufacture of fertilizers air pollution can occur as a result of the use of air for product cooling, drying and ventilation and its control can best be divided into three categories.

(a) Product Recovery in which the airborne product is collected for further processing or sale. Dry filters are obviously necessary for this duty.

(b) Material Recovery involves the capture of dust (by dry collectors) or fumes (by wet collectors) which are then returned to the process or sold as by-products.

(c) Air Pollution Control which involves the elimination from the plant exhaust of any pollutants which constitute a health hazard or are a nuisance.

In the manufacture of diammonium phosphate fertilizer phosphoric acid, sulphuric acid and anhydrous ammonia are mixed, crystallized, dried, cooled, crushed and screened to a finished fertilizer product, a process in which Mikropul venturi and cyclonic scrubbers effectively eliminate dust problems.

The phosphoric acid is either electric furnace or filter grade, as a rule, with the latter having the greater usage. The filter grade acid (25 to 30 per cent P_2O_5) still contains considerable amount of fluorine which will be liberated in the reaction of ammonia and acid.

The chief pollutants on these applications are ammonia and fluorine which require two separate systems for recovery and control. Ammonia is recovered in a primary stage venturi scrubber by scrubbing with 25-30 per cent P_2O_5 and recirculating this solution back to the neutralizer.

Fluorine is removed by additional fresh water scrubbing in a separate cyclonic scrubber following the venturi scrubber.

The scrubbing system for both ammonia recovery and fluorine abatement consists of dry cyclones and venturi scrubbers for the dryer, cooler, screens and mill gas streams. Venturi and acid scrubbing cyclonic types are used on the ammoniator-granulator stream. Some or all of these gas streams are combined into a tail gas fluorine abatement scrubber.

The accompanying diagram of a diammonium phosphate fertilizer plant illustrates the way in which Mikropul cyclones and scrubbers are used for the elimination of pollution from this type of plant.

Reader Enquiry Service No. **7286**

Drive to Clean up Car Exhausts Accelerates Demand for Industrial Purifier

World-wide concern about the dangers of air pollution from motor cars is apparently having a dramatic effect on the market for industrial exhaust purifiers. Engelhard Industries, who have been supplying their PTX units for goods handling and mining equipment for many years, report a suddent upsurge of interest. Sales in the United Kingdom for the first quarter of this year have exceeded the figure for the first half of 1971.

"There is no doubt," says Mr. B. D. King, Engelhard's Manager for Gas Equipment Sales, "that the general anxiety about automobile emissions has alerted the man on the shop floor, the miner and the dock worker to the dangers of breathing exhaust fumes at work. The noxious concentrations there, may be many times anything he will meet on the way home."

Furthermore, now that the workers are aware that something can be done about exhaust gases, they are demanding action.

"We're also finding," reports Mr. King, "that management is now convinced that drowsiness, accidents and ill-health suffered by operatives through working in a polluted atmosphere, is just plain inefficient—and represents an economic as well as a human problem. What's bad for people, is clearly bad for profits."

The Engelhard PTX Purifier looks rather like a conventional silencer but is filled with platinum catalyst deposited on a ceramic honeycomb. Mounted close to the exhaust manifold, the catalytic converter oxidizes the unpleasant hydrocarbons and toxic carbon monoxide to produce harmless carbon dioxide and water vapour.

While motor manufacturers are still evaluating the PTX as part of a system to meet the new and very stringent regulations governing automobile exhaust emissions, the Engelhard unit continues in its original and most successful role of improving the industrial environment. It is fitted to fork-lift trucks, tractors, mining locomotives, dumper vehicles and on slave engines used to power pumps, compressors, saws and other equipment.
Reader Enquiry Service No. **7287**

F. E. Beaumont Awarded Contracts

F. E. Beaumont Limited have been awarded a contract valued at nearly £50,000. They have designed, manufactured, transported and erected at the Humber Refinery of Conoco Ltd. at Immingham, near Grimsby, Lincs., a 350 ft. high self-supporting, fully insulated steel chimney 4 ft. 9 in. minimum diameter. It is fitted with aerodynamic helical stabilisers to minimise wind excited oscillations.

The Beauvent chimney was manufactured at the Beaumont factory in Mere, Wiltshire, transported to site and then completely erected and handed over to the client on 12 August 1972. It is believed that this is the highest single self-supporting steel chimney in Europe.

This chimney is of Beaumont's patented "Econoflu" design and it incorporates an insulated steel liner which carries the waste gases from a sulphur recovery plant.

The height of the chimney is dictated by the Clean Air Act and is designed in accordance with British Standard 4076.

The total weight of the chimney exceeds 180 tons. F. E. Beaumont Limited have also been awarded a contract valued at over £23,000 to design and manufacture a Beauvent Multi-flue aluminium clad steel chimney 123 ft. high × 11 ft. diameter with three inner insulated steel chimneys, two at 24 in. diameter and one at 29 in. diameter, lined with a monolithic refractory lining. Provision will be made for a further five inner chimneys to be erected at a future date. A range of horizontal flues and an incinerator chimney is also included in the contract. Beaumont's will be erecting the chimney at the Stoke Mandeville Hospital in Buckinghamshire.
Reader Enquiry Service No. **7288**

Research into the Behaviour of Particles

Four research projects in particle technology submitted by Professor D. C. Freshwater, Head of the Department of Chemical Engineering at Loughborough University of Technology, are to be supported by Science Research Council grants totalling £42,562. Each of the four projects is part of a unified three-year programme of research into the basic behaviour of particles, dealing with particle characterization, the flow of granular materials, mechanisms of fibrous filtration under load and aerosol migration.

Particle technology is a subject of considerable importance in a very wide range of industrial processes. Chemical engineers need much more information about the behaviour of particles so that they can predict the effect of the mechanical, electrical or thermal forces concerned in an industrial process. The Loughborough research team will be tackling this problem on a broad front. The grant provides for a Quantimet 720 and associated equipment for measuring filament distributions and area porosities. Studies of the stress on a sample of granular material in relation to the overall applied porosity change and to the change in the structure of the granular bed could provide information affecting the design of bulk handling equipment, the packing of powders and their use in processing systems. The investigation of particle capture mechanisms in fibrous filters under load will include small particles in the range 0·05-0·3 μm which present a potential hazard to health and to fine tolerance engineering systems. The theoretical study of forces—in particular heat and light—affecting sub-micron particles suspended in a gas will contribute to the understanding of these problems in relation to industrial processes and atmospheric pollution.

Nailsea Engineering Company Ltd.

Nailsea Engineering of Blackburn, British specialists in the control of air pollution, have just won a contract from the Cheshire and North Wales Tarred MacAdam Company . . . who took delivery of the very first Nailsea jet bag filter back in 1959. A 108/0 Filter should be operational by late summer, extracting dust from a culted stone mixer house where conditions at present are very dusty. The Nailsea filter will be extracting from two sources—the mixer itself, and the stone-feed-in point.

Three other Nailsea installations are being used currently at the Cheshire and North Wales quarry in Mold—two on rotary stone dryers and one on the classification of dust system.
Reader Enquiry Service No. **7289**

National Industrial Fuel Efficiency Service Limited

A new Company called National Industrial Fuel Efficiency Service Limited (NIFES) has been set up to acquire the formerly Government owned National Industrial Fuel Efficiency Service with effect from 1 July. The new NIFES has a paid-up share capital of £20,000 subsidised by 70 members of the staff of the old Company.

The original company was formed by the Government in 1954 on the recommendation of the Pilkington Committee to advise industrial and commercial organisations on the efficient use of all forms of energy. Owned by the Department of Trade and Industry it was subsidised by the Coal, Gas and Electricity Boards until 31 March 1969, after which the Treasury gave it a diminishing grant-in-aid for three years to enable it to reach commercial viability on its own, on the understanding that this would cease after 31 March 1972.

The senior staff of the company have now reached agreement with the Department of Trade and Industry whereby the new NIFES has bought the assets and undertaken to dis-

charge the liabilities of the old company. They will pay the D.T.I. £100,000 over the next six years, out of which the D.T.I. will discharge loans of £72,000 from the Nationalized Industries. The agreement is based on a guarantee from the company's merchant bankers, Henry Ansbacher & Co., backed in turn by staff guarantees.

The Directors of the new NIFES are Bill Short, one of the Directors of the old Company, Henry Weston and Frank Beveridge, who believe that reasonable profits can be made in the current year by making full use of net assets which stand at £290,000 in the balance sheet at 31 March 1972.

In addition the pension fund of NIFES accumulated over the years has assets recently valued at some £1·5 million.

The company has become increasingly involved in engineering consultancy in addition to its original role and it is in this area that further expansion is anticipated. The structure of the company is being completely reorganised with the country divided for technical services into Northern and Southern areas with an administration office at 54/58 Bartholomew Close, London.

Rolfite

Detailed investigation at Imperial College of Science & Technology in London fully substantiates claims made for 'Rolfite' as an anti-air pollution fuel oil conditioner without capital outlay.

Test Boiler Short length combustion chamber, 3 burner water tube marine type, 6,000 lbs. per hour steam at 200 p.s.i.g. with 700°F superheat, fitted with economiser.

Fuel Oil 1,000 Redwood seconds with 3 per cent sulphur content.

Claims for Rolfite '404'

(a) Improved combustion with lower excess air.

(b) Considerable reductions in:
1. Air pollution from smoke, acid smuts and sulphurous fumes.
2. Corrosion by SO_3 and V_2O_5.
3. Carbonaceous deposits throughout gas passages.

(c) Resulting in substantial cost savings in:
1. Fuel consumption.
2. Major overhauls and running maintenance.

(d) Leading to:
1. Cost of 'Rolfite' more than covered by savings.
2. Reduction in air pollution at no additional cost.

Test Results
1. Boiler efficiency improved from 84·3 per cent to 88·1 per cent.
2. Pounds steam per pound of oil increased by 4·3 per cent.
3. Air draught reduced by 50 per cent with no increase in smoke emissions.
4. Sulphur trioxide in stack gases reduced by 40 per cent.
5. Old deposits unseated from boiler tubes and economiser.
6. Fireside deposits comprised thin dry dust coating, neutral in chemical activity and removable by compressed air.

A technical consultative service is given by the Rolfite Company's U.K. Representative, C. G. Henson, 'Overmead', Blackberry Road, Lingfield, Surrey, from whom a similar proven complex for diesel and petrol engines is available.

Rolfite '404' is simply added to main storage tanks at fuel-oil deliveries and being self dispersant requires no agitation or stirring.

Rolfite '404' adds approximately 2 per cent to fuel costs but shows proven fuel savings of 4·3 per cent and savings "in the field" applications in the U.K. of 4 per cent to 8 per cent with added savings in maintenance and reduced air pollution as a bonus.

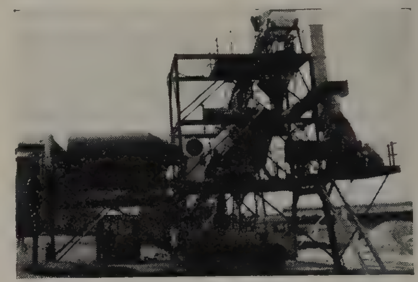
Rolfite '404' has been given a safety permit by Massachusetts U.S.A. Dept. of Public Health as not causing or contributing to air pollution injurious to public health.

Rolfiite '404' in the usage ratio of 1:4,000 provides less than 3 ppm of manganese as a catalyst in the treated fuel and, even assuming all the manganese leaves the stack, produces no more than 0·12 milligrams of manganese per cubic metre of stack gases. Considering a dilution factor of 1,000 in ambient air this gives no more than the minute quantity of 0·12 micrograms per cubic metre of air, compared with the threshold in America for managnese in an 8 hour day set at 5 milligrams per cubic metre of air.

Reader Enquiry Service No. **7290**

Cleanway D.F.E. by Coatmaster First Ever U.K. Dust Free Emission Coating

Located at Redland Roadstone's Mountsorrel Quarry, near Leicester, is a unique bituminous coating plant representing a totally new concept in coated stone manufacture. "Coatmaster", a plan of low height, occupies an area of approximately 66 square metres, and is capable of mixing 60/90 tonnes per hour of 'blacktop' products. It is situated in the shadow of the much higher conventional plant of similar capacity, supplied by Underground Mining Machinery Limited some years ago. The Coatmaster is undergoing final proving tests of a tight development schedule.



The innovative process, "Cleanway D.F.E." is the result of joint efforts by Underground Mining Machinery Limited, a member of the Westfalia Lunen Group of Companies, and Redland Roadstone Limited a subsidiary of Redland Limited.

The process is entirely contrary to existing practices, cold damp aggregates are associated with bituminous binders and subsequently heated producing a high quality product. The mix constituents are exactly the same as those used in conventionally produced materials but there is evidence that the new product will have a better overall performance.

Using cine-micro-photographical techniques, Redland Research & Development have observed that, as the water is driven off, considerable bubbling takes place causing agitation, which assists the flow of bitumen to the sites vacated by the water, these sites being occupied by the binder more tenaciously than when dry stone is coated—a kind of vacuum impregnation takes place. Further confirmation is demonstrated by improved Immersion Wheel Tracking Test results made in Redland Roadstone's laboratory.

The "Coatmaster" plant does not emit dust, all the fine particles being retained within the mix throughout the process. Until the development of this plant the achievement of a dust free emission involved the use of complex dust collectors which present difficult problems of maintenance and handling of collected dust.

Batches of cold aggregate, proportioned as required, are fed to the unit, check weighed, water and binder added and the batch presented to the hot gases within the barrel where moisture evaporation and coating takes place. As the water evaporates it is replaced by molten binder, securing a dust free air stream and hence the exhaust stack is at all times completely clean. By utilizing an infra-red pyrometer temperature control, accurate discharge temperature can be achieved.

Reader Enquiry Service No. **7291**

Amey Asphalt

New propane gas heated machines which can operate in cities without polluting the atmosphere have been added to the fleet of heating and planing machines operated by Amey Asphalt in 1972. These self-propelled machines in one combined operation heat the road surface, cut it to a controlled depth and remove the surplus material by elevator into an attendant lorry. Traffic can move freely during the operation. New types of elevators and cutting equipment, the result of co-ordinated development between Amey Engineering, who design and build the machines, and Amey Asphalt, have improved the operational efficiency of existing machines. As areas of road surfacing increase with national road building programmes, so there is a greater demand for Amey Asphalt's specialized heating and planing systems.

Order for Gas Cleaning Plant for Rochdale Refuse Incinerator

An order valued at more than £70,000 has been placed with W. C. Holmes & Co. Ltd. by Redman Heenan Froude Ltd. for gas cleaning plant for the 8 tons per hour refuse incinerator which they are supplying for the County Borough of Rochdale Cleansing Department, Superintendent Mr. R. C. Biddulph. The contract is supervised by Mr G. R. Hope, Borough Engineer & Surveyor.

The gas cleaning plant includes a two-field electrostatic precipitator designed to give an outlet dust burden not exceeding 0·1 grains per cubic foot of dry gas at NTP when handling exhaust gases at 570°F. Holmes are also supplying the necessary ducting from the conditioning tower to the chimney.

Traffic Noise

Quieter vehicles and stricter enforcement of measures to keep them quiet: These watchwords emerge from the recommendation of a report, Traffic Noise, the Vehicle Regulations and their Enforcement, obtainable from HMSO, 50p, was published recently by a working group of the Noise Advisory Council.

Mr. John Peyton, Minister for Transport Industries, has welcomed the report as a realistic and valuable contribution in the field of traffic noise abatement and has pledged the Department of the Environment to a careful study of the working group's recommendations.

The group recognise the importance of the environmental and educational aspects of the campaign against traffic noise—keeping the noise as far as possible away from people, and bringing home to drivers that they should use their vehicles quietly. But they see bigger and more immediate advantage in the development and production of quieter vehicles and in regulations to ensure that vehicles on the road make the least possible noise.

They urge that top priority be given to the recently announced five-year project for the development of a quiet heavy goods vehicle. This may result, as early as 1980, in the mass production of heavy lorries as quiet as present-day cars.

The group would also like to see regulations banning the fitting or selling of ineffective silencers and setting minimum standards of durability for silencers. The annual test for vehicles should, they believe, include a visual check on exhausts and silencers.

Much thought is given by the group to noise limits for vehicles in use, which they regard as a vital part of any programme to alleviate the nuisance from traffic noise. Such regulations exist, but the group recognise that proper enforcement is necessary to give teeth to the law.

Filtration Society Conference

"What's New in Filtration and Separation Engineering" will be the theme of the Filtration Society Conference taking place at Olympia, London, from 25-27 September, 1973.

Non-members—as well as members—of the Filtration Society are being invited to submit papers for the Conference. Authors should send four copies of the titles and synopses (maximum 100 words), preferably in English, of proposed papers by *1st October, 1972.*

Further information about the Conference and Exhibitions can be obtained from the Filtration Society, 1 Katherine Street, Croydon CR9 1LB, England (01-686 6339).

THE QUEEN'S AWARD TO INDUSTRY 1973

The Office of The Queen's Award to Industry has announced that application forms and guidance notes for the 1973 Awards are now available. The Award can be applied for by any United Kingdom based organization producing goods or providing services who seek recognition for outstanding achievement in increasing the exports of this country or in the advancement of product or process technology. The last date for applications is 31 October 1972.

Enquiries about eligibility for the Award and Application Forms should be made to:

The Secretary
Office of The Queen's Award to Industry
1 Victoria Street
London SW1H OET.
Telephone No.: 01-222 2277.
Telex No.: 27366.

Emissions to the Air

The London and South Eastern Branch of the Institution of Chemical Engineers are holding a symposium, with the provisional title of "Emissions to the Air", at the Royal Aeronautical Society, London W1, on 9th November 1972.

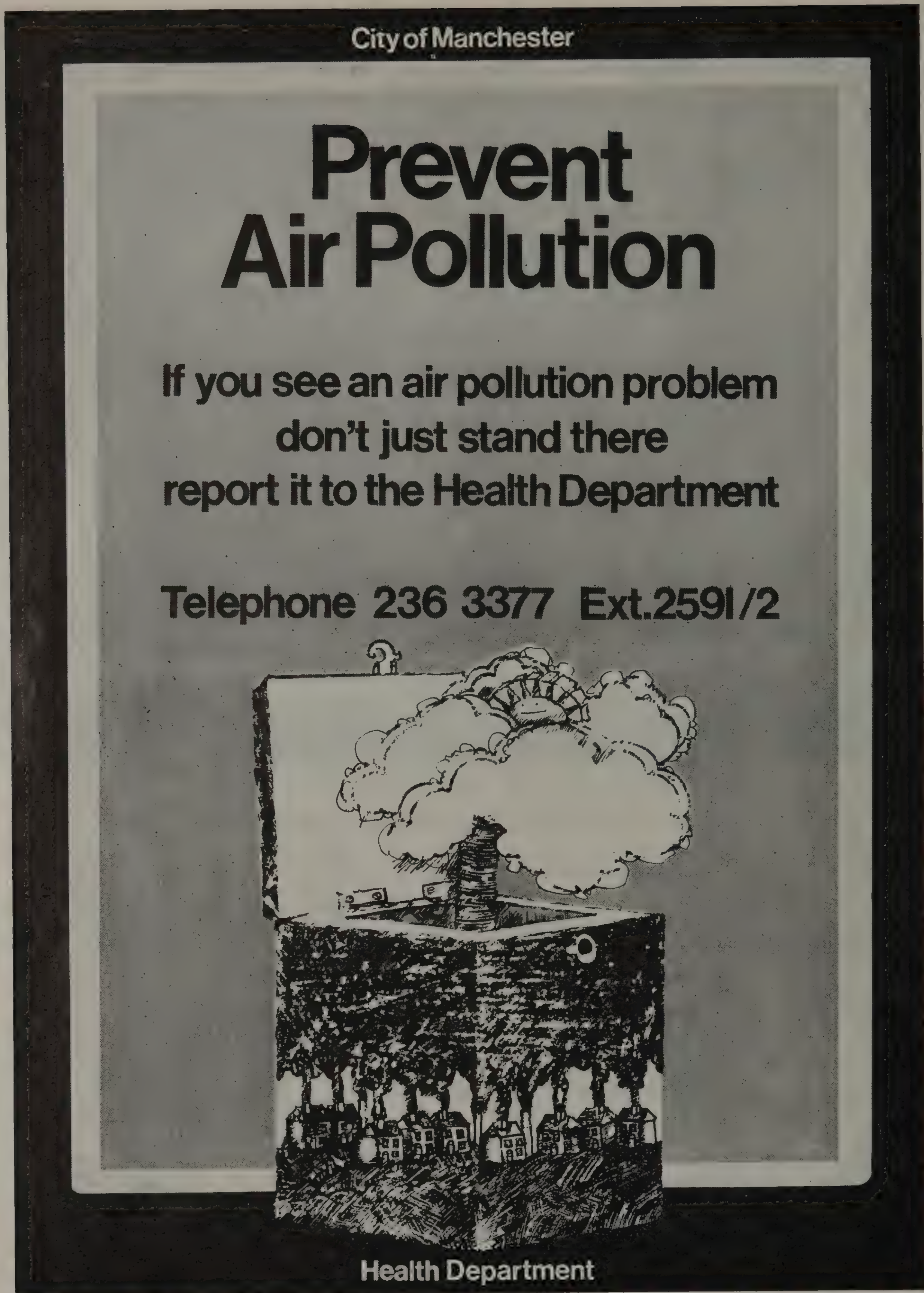
The symposium is intended to be of interest to the professional engineers in industry responsible for air pollution control in either plant operation, design or construction. The basis of the Alkali & Works Legislation is that "best practicable means" should be used for the control or minimisation of air pollution from registered works. "Best practicable means" has to be updated by the inspectorate whenever possible. The purpose of the symposium is to provide facilities for different industries scheduled under the Acts and Orders to discuss and compare the developments in "best practicable means" in their industry.

The papers from invited speakers from the Alkali Inspectorate and Industry will cover:

In the morning: particulate emissions, and atmospheric dispersion.

In the afternoon: emissions from oil refining, petrochemical works, inorganic chemical works and toxic ions.

Further details are available from D. E. Shillito, Cremer and Warner, 140 Buckingham Palace Road, London SW1W 9SQ.



We have received a poster, reproduced above, from the City of Manchester and would commend this to our members. We feel sure that if more reports of this kind were made to the appropriate Health Departments, nuisance could be dealt with much more quickly and effectively.

CLEAN AIR

READER ENQUIRY SERVICE

FOR MORE INFORMATION and catalogues relating to advertisements in this issue insert the reference number appearing below each advertisement and post to Clean Air, 134 North Street, Brighton BN1 1RG

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BRITAIN'S LEADING AIR POLLUTION JOURNAL

CLEAN AIR

incorporating "Smokeless Air"

WINTER 1972
VOL. 2 NO. 8

PRINCIPAL CONTENTS

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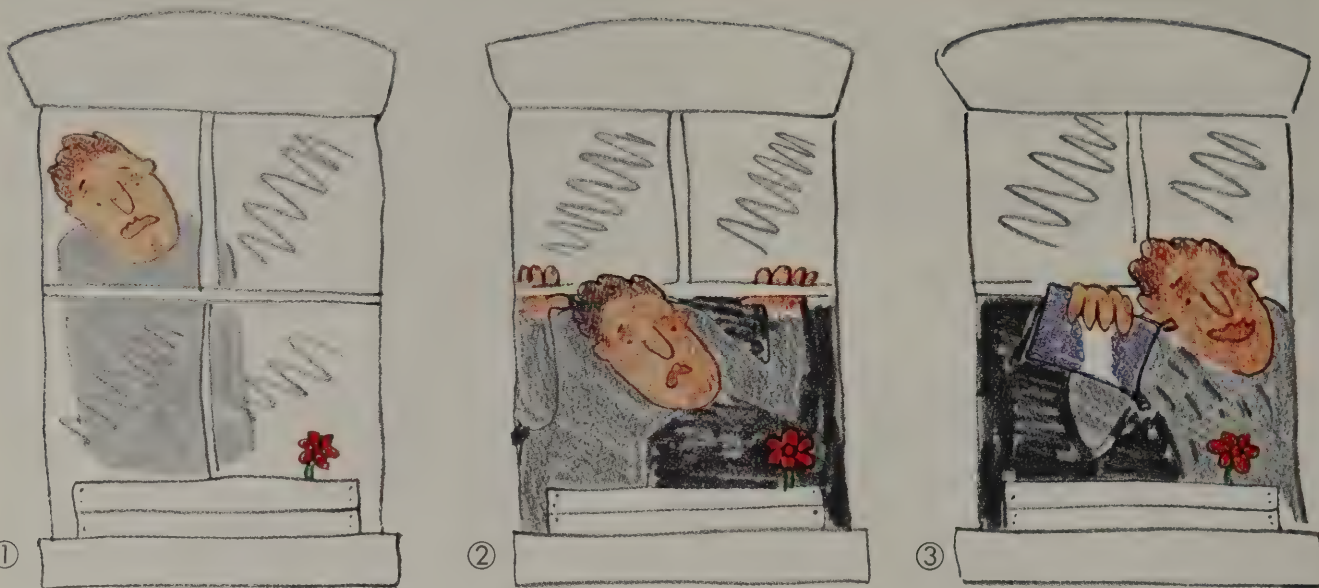

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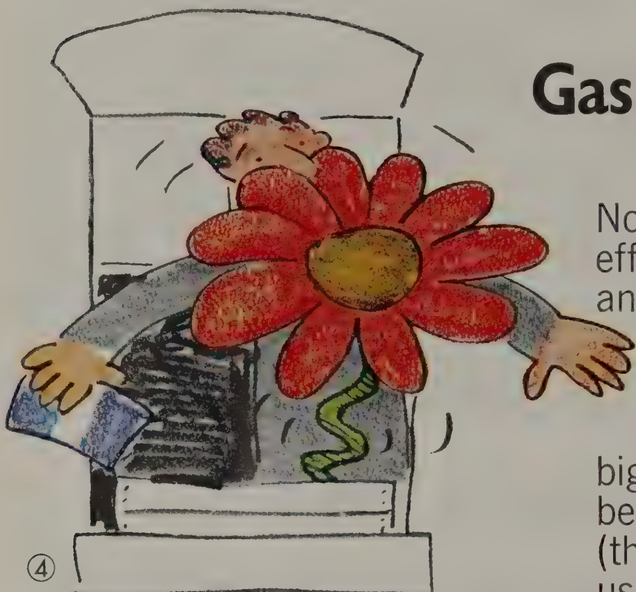

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CLEAN AIR

THE JOURNAL OF THE NATIONAL SOCIETY FOR CLEAN AIR

Vol. 2 No. 8 **Winter 1972**

Principal Contents

Index to Advertisers

CLEAN AIR is published quarterly by the National Society for Clean Air at 134/137 North Street, Brighton BN1 1RG. Tel: Brighton 26313.

Editor: Rear Admiral P. G. Sharp. Assistant Editor: Suzanne Martin

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Advertising Rates available on application from the Society.

"This most excellent canopy, the air"

CLEAN AIR

SMOKE CONTROL IN THE NORTH EAST

It is now 20 years since the great smog of December 1952, the smog which caused the Government of the day to take action and appoint the Beaver Committee to enquire into the whole situation.

The Beaver Committee, as is now well known, reported in 1954 and recommended legislation which would establish smoke control areas and which expressed the hope that the whole country would be subject to smoke control by the mid-1970s. In the event, although great progress has been made, this hope has not been realised as the following table of the percentages of total black area premises in each region covered by smoke control orders, confirmed or awaiting decision at the 30th September 1972 shows:

Region	*Percentage of Premises*
Greater London	88.2
Yorkshire and Humberside	64.9
North West	60.0
East Midlands	46.5
West Midlands	42.4
Northern	38.5

The Clean Air Council, which is appointed by the Secretary of State for the Environment for the purpose of keeping under review progress made in abating air pollution in England and Wales and of obtaining specialised advice on clean air matters, have for some time been considering what further action could be taken to stimulate smoke control in the "backward" regions. Accordingly, in February of this year a Panel of members, to which were added representatives of local authorities in the Northern Region, was appointed with the following terms of reference: "To examine the progress of domestic smoke control in the "black" areas of the Northern Region, to suggest improvements insofar as practicable and to advise the Clean Air Council upon any further steps which should be taken to this end."

The Panel held, in all, three one-day meetings in London and a one-day meeting and three two-day meetings in the Northern Region to hear evidence from the local authorities themselves. These meetings were held in different places in the region in order that the Panel's activities should become widely known and to give the members of the Panel the opportunity to see local conditions for themselves whilst at the same time meeting the representatives, both elected members and officers, of the 19 "black" local authorities on their own ground. In their report, which has recently been issued, the Panel state that they believe that this approach increased their appreciation of the point of view of the local people concerned and of their elected representatives, and provided a feeling for the problems of the region which they would not otherwise have acquired. It also helped the Panel to assimilate the written evidence which they collected and exerted a great influence not only on the way in which the report was assembled but also in the recommendations which the report has made to the Clean Air Council and the Secretary of State for the Environment.

The Panel considered it proper that the report should contain information about the character of the region, why 19 particular local authorities should have been categorised as "black" and why the terms of reference should have referred specifically to their progress rather than to that of their neighbours. In the same way, due regard was paid to the region's industrial history and its present difficulties of unemployment and finance.

In the summary of conclusions and recommendations, the report states "The natural environment of the Northern Region and the purity of its air, have in the past, been sacrificed to create wealth for the rest of England. Now the region is suffering from the rundown of its industries and the consequent unemployment. The necessity to save and create jobs has understandably resulted in a lower priority being given to clean air than elsewhere, but there is a growing awareness of its importance . . .

More money has been needed in this region than in others for modernisation and reclamation schemes. Much enterprise has already been shown. It is now practicable and essential that priority should be given to smoke control . . . .

Ways should be sought of helping regional authorities to finance vigorous programmes of smoke control from the locally determined sector. In our opinion there is a more practicable alternative than placing smoke control in the key sector of local authority expenditure."

The panel recommends that all local authorities should prepare smoke control programmes covering their entire areas, and that they should be ready to consider financing this from capital. At the same time, the Department of the Environment should examine with the local authorities concerned how best to make available financial resources adequate to prosecute smoke control vigorously.

The Panel also recommends that two local authorities should be pressed by the Secretary of State for the Environment to consider their responsibilities more energetically and further recommends that the Secretary of State should formally consult, pursuant to his powers under Section 8 of the Clean Air Act 1968 with four other local authorities. All these six authorities are named in the report. This "naming of names" is a new departure which was not undertaken lightly, and when the matter was considered by the Clean Air Council and the Department of the Environment, great thought was given to this point. After much debate and heart-searching it was decided that the names of these authorities should be published.

Although this bold step may be unpalatable to some, it should be remembered that for many years reference has been made to "laggard authorities". Although the names of authorities in this category have not been specifically mentioned, it has always been possible by examination of smoke control order returns to find out who these were.

Whether one agrees with "naming names" or not, there is no doubt that the work of the Panel and its subsequent report has already had a stimulating effect on the Northern region. The Department of the Environment is now receiving proposals for further smoke control orders and there will very soon be a considerable improvement in that part of the country. This will mean that other regions will have to look to their laurels if they are to avoid falling behind.

Probably the most important finding of the Panel, and this was nothing new, was that where there was a will amongst the elected representatives to introduce smoke control, no difficulties, financial or otherwise, were encountered. It is still this will to carry out smoke control which is required and it is to be hoped that this will be exercised so that the end of the present decade will see the whole country subject to smoke control.

"The Air You Breathe"

This is a new colour filmstrip/slide set with accompanying notes, produced by Diana Wyllie Ltd. The frames and the notes have been prepared in close co-operation with the Society. The set is designed to tell the story of air pollution, its control and prevention in 43 frames. The script shows that all pollution of the air is not man-made; it distinguishes between man-made pollution caused by combustion and that emanating from non-combustion processes, and the various forms and sources of pollution and its effects are clearly illustrated by the frames.

Originally intended for schools, it became clear as production proceeded, that the set could have a much wider appeal and application. The notes have therefore been written in such a way that they form a basis on which the lecturer can develop his theme to suit his particular audience. Similarly the frames and notes can be tailored to the time available for a lecture or a lesson.

The strip was first presented to the Open Session of the Clean Air Conference at Scarborough on 17 October, 1972. This audience was made up of delegates to the Conference, many of whom were experts in the field of the control and prevention of air pollution, members of local organisations and the general public and a large number of schoolchildren. The presentation was well received by all.

At a time when there is increasing awareness of the environment and a growing demand for talks and lectures on clean air, we feel that this filmstrip will prove to be a valuable aid.

The cost of the set is £3; sets may be obtained from the Society.

Smoke from Burning Plastics Symposium

The smoke hazard caused by plastics foams in fires will be dealt with in one of the papers to be given at a symposium next February—the first in this country to deal with the smoke problem arising from burning plastics.

Smoke and toxic products are the cause of more deaths in a fire than any other factor. The increasing concern about the problem—which may give rise to legislative action—is part of the background to the staging of this conference.

Called "Smoke from Burning Plastics: fundamentals and practice", the one-day symposium is organised by I.M.R.U., the Industrial Materials Research Unit at Queen Mary College, Mile End Road, London, E.1.

It will be held at the College on Thursday, 22 February, 1973. Smoke and plastics foams will be discussed in a paper from Mr. A. C. Barrell of the Factory Inspectorate.

Other papers will be given by A. M. Berman, G.L.C.; Dr. W. D. Woolley, Fire Research Station (on toxic products); Dr. T. S. McRoberts, I.M.R.U. (opportunities and problems); K. A. Scott, R.A.P.R.A. (on measurement of smoke), and Professor D. A. Smith with Dr. P. Karam, I.M.R.U. (on fundamental aspects).

Full details from the conference organiser, Miss Kim Walcot, 01-980 9291.

SCARBOROUGH CONFERENCE

This year the Conference moved back to its normal time, the middle of October, but the weather, although satisfactory, was not as favourable as it was in Folkestone last November. Nevertheless it did not interfere with any of the Conference activities and the brisk northeaster which blew on the last two days was, to say the least, bracing.

The Conference was well attended and again there was a slight increase on the previous year in the number of full time registrations. Attendance at all sessions was good, that at the last session on the Friday morning being particularly so. The papers presented were of a very high order and the subjects which they covered certainly broke new ground. As a matter of deliberate policy, the number of papers presented was reduced this time and this allowed the speaker slightly more time to develop his theme and certainly allowed much more time for discussion. In the event all available time at all discussion periods was fully taken up, but this was done without having to cut anybody short and without having to hurry the proceedings in any way at all.

The Platform on the Thursday morning

There were a number of new departures this year, the principle one being that the Conference was opened on the Monday evening rather than on the Tuesday morning. This innovation was well supported as there was a very good turn out of delegates to listen to the welcome from the Mayor of Scarborough, Councillor Miss I. C. Slarke, the Opening Address by Lord Kearton, O.B.E., F.R.S., and the Presidential Address from Mr. Stanley E. Cohen, C.B.E., C.C., F.R.S.A. After completion of the opening ceremony, delegates were able to meet and get together much as they have done in former years. But by having the Opening Session on the Monday evening it was possible to start the first technical session at 10.00 on the Tuesday morning; and by so doing it was possible to include five full technical sessions in the Conference programme as well as allowing the Wednesday afternoon to be set aside for technical and social visits, and for golf, tennis and squash.

The Tuesday afternoon was given over to the "Top of the Form" type quiz for local schools. After advice from the education authorities concerned, 22 schools in the Scarborough, Whitby, Bridlington area were asked early in the year if they would allow their pupils to take part in this competition. Seven schools stated that they would co-operate, and in the event, a total of 400 children from the following six schools entered the competition: The Grammar School, Whitby, The Bridlington High School for Girls, The Eskdale County Modern School, Whitby, The Scarborough High School for Boys, The Girls' High School, Scarborough, and the Westwood Secondary School, Scarborough. The first part of the competition took the form of a written examination which was held at the end of the summer term 1972. The judges, provided by the Yorkshire Division, selected the following individual prize winners: 1st, Ian Summerscales of the Scarborough High School for Boys; joint 2nd, Peter MacPherson, Westwood Secondary School, Scarborough, and Jillian Boulton of the Girls' High School, Scarborough; 3rd, Howard Smith of Whitby Grammar School. The judges also selected three schools to be asked to provide teams of four each to take part in the actual quiz which was held in the Grand Hall, at the Spa, on the afternoon of Tuesday, 17 October. These schools were the Grammar School, Whitby, the Girls' High School, Scarborough, and the Westwood Secondary School, Scarborough.

The winning team with members of the staff of Westwood Secondary School

The Question Master was Alderman Norman Fuller of Scarborough and he was supported by Messrs. Eastwood and Perry of the Yorkshire Division of the Society who acted as "expert" advisers. The three competing teams were seated on the platform at suitable tables which were provided with microphones and name cards. The quiz consisted of three rounds of individual questions and two rounds of team questions and lasted in all for about 45 minutes. The winning team was that from the Westwood Secondary School; Whitby Grammar School tied with the Girls' High School for second place. This necessitated a "sudden death" question and the boys just beat the girls to it, and so the final result was 1st, Westwood Secondary School, Scarborough; 2nd, Whitby Grammar School and 3rd, the Girls' High School, Scarborough.

The schools taking part had brought with them their supporters and the session was quite lively. After the quiz was over the Mayor very kindly presented prizes to the individual prize winners and the members of the teams. Prizes had been donated by Coalite and Chemical Products Limited, National Coal Board, Yorkshire Sales Region, Solid Smokeless Fuels Federation, the Yorkshire Electricity Board, North Eastern Gas Board, Shell Mex and B.P. Ltd., and the West Riding Advisory Council for Clean Air and Noise Control. The Society is indeed grateful to these organisations for so generously contributing. In addition to prizes for the children themselves, the three schools which took part in the quiz also received substantial prizes. In addition, each of the children taking part in the quiz received a copy of the Shell Country Book kindly donated by Shell Mex and

The Conference Dinner

The team from the Girls' High School, Scarborough

The team from Whitby Grammar School

B.P. Ltd. The quiz was undoubtedly a success although it was clear that some of the competitors seemed to find the questions asked rather difficult. This was not so much because of the actual difficulty of the questions but possibly more because of the language in which the questions were couched. Undoubtedly the organisers have learned quite a lot from this first quiz, and it is hoped that it will be possible to organise a similar quiz at some future conference.

The social side at Conference followed the pattern of previous years. There was no informal "get together" as such on the Monday evening but this in fact did take place following the opening session. On the Tuesday evening the Chairman of the Executive Council, Mr. Stanley Cayton, M.B.E., gave the customary reception at the Royal Hotel and this was a very pleasant occasion. On Wednesday evening the Conference Dinner and Dance was held at the Royal Hotel. This was not as well attended as last year but those who did attend had a most enjoyable evening. The principal guest was the Mayor and the speeches were of a high standard, and afterwards there was comfortable room for dancing. On the Thursday evening, the Mayor and Corporation of Scarborough entertained delegates to a dance, cabaret and reception at the Spa, again a very happy occasion.

Technical Visit to B.P. Chemicals International Limited, Hull

On the afternoon of Wednesday, 18 October, 36 Conference delegates took the opportunity to visit the above works. The party was received by Mr. Claydon accompanied by two colleagues, viz. Messrs. Auskerin and Lazenby.

These gentlemen gave a brief but most informative account of the operation of the plant and very kindly answered the many questions put to them.

Some 500,000 tons of chemicals are produced annually, most of the processes being registerable under the Alkali Acts. The firm's representatives stressed the great importance placed upon good public relations and stated that all complaints are investigated.

Reference was also made to "best practicable means". That the firms are anxious to be good neighbours is evidenced by the fact that 5 per cent of annual capital expenditure is taken up by environmental control measures.

Tea was kindly provided for delegates by the management.

Technical Visit to I.C.I. Wilton

A technical visit was made by arrangement with I.C.I. Limited to their extensive petro-chemical works at Wilton on Teesside.

Thirty-seven delegates journeyed by coach through the glorious Yorkshire countryside and were met at the Works by Dr. K. W. Gee and a description of the works, the methods of manufacture of the multifarious petro chemical products was given.

Questions on the control of atmospheric pollution, odours and noise were diplomatically dealt with by the staff and later a conducted tour was made of the various establishments including the large power station in which waste process gases and liquids were burnt as well as conventional fuels.

The delegates were entertained to tea in the staff dining room and a vote of thanks to the Management and staff was ably proposed by Mr. Taylor Nobbs from Northern Ireland.

It was the opinion of all that the visit was both interesting and instructive.

Technical Visit to British Steel Corporation, Lackenby

A number of delegates visited the British Steel Corporation Works at Lackenby, South Teesside, where the Basic Oxygen Process of steelmaking is in operation. This new B.O.S. plant, together with the adjacent casting facilities, represents one of the largest and most comprehensive steel producing units of its kind in the western hemisphere.

A history of the works and a description of the process was first given by the management and then followed a guided tour. Delegates saw the plant in operation, witnessed the rolling process and the cutting of the steel. Of particular interest to the visitors was the clear evidence of the success of the efforts taken to combat pollution. Huge sums have been spent on clean-air equipment and pollution control specialists have been appointed to co-operate with the local management.

At the conclusion of the tour there was a general discussion on pollution control in the steel making industry.

Delegates expressed their thanks to the management for the interesting visit and the hospitality.

Technical Visit to Eggborough Power Station

A party of 24 visited this CEGB Power Station; a 2000 MW coal fired plant. The object of the visit was the detailed SO_2 pollution survey and plume dispersion measurements being made at this station, which was one of the first to be equipped with a single multi-flue chimney. Mr. H. G. Masterson, Regional Controller of Scientific Services, welcomed the party and introduced members of his staff who described the different facets of their work. A short film was shown explaining the nature of the research being undertaken and showing by animated diagrams the principal features of dispersion from tall chimneys.

The party then visited the central data logger installation where a constant flow of information from the pattern of 24 continuous SO_2 recorders and an array of meteorological instruments at various levels on a tall TV transmission mast some miles away, are collected by land line and punched on to paper tape ready for computer analysis. The party also saw the two methods used for measuring plume rise; the adapted cloud search light and the laser technique (LIDAR) which is extremely sensitive and accurate. The party examined and discussed some of the survey results and then partook of a sumptuous tea. Dr. Reay expressed the thanks of the party to the CEGB for their kind hospitality and congratulated the Board on the technical excellence of the research work they had seen.

Visit to Hornsea Pottery

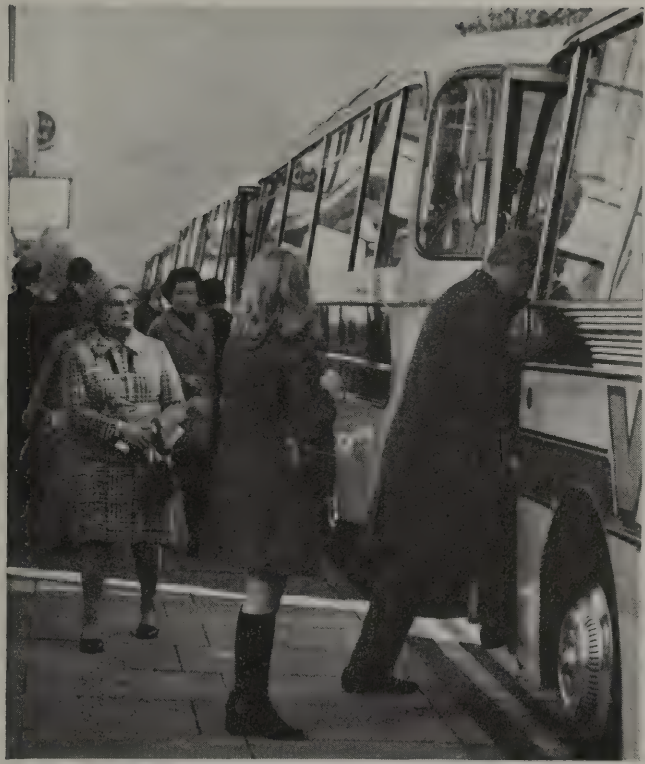
After an initial set-back due to a mix-up between the Coach Company and Hornsea Pottery, 51 people enjoyed an interesting tour of the Pottery. All the various stages of production, from preparing the clay to the finished glazed product, were shown. All Hornsea Pottery is machine-made and not hand-thrown, and the visitors were amazed how much could be produced in a day in such a small building.

The Pottery is surrounded by a miniature zoo and a children's playground. Flashing lights and a public address system, plus very efficient guides, completes its tourist attractions.

An inspection of the shop, where good "seconds" at reduced prices were for sale, completed the visit.

Social Visit to York Minster

On Wednesday afternoon a party of approximately 100 delegates and their wives drove through richly farmed countryside to York, where they saw a glimpse of the ancient streets within the city walls as they



walked to the Minster. Here they longed for more time but were well able to take in the glories of the newly restored cathedral with its wonderful medieval glass. A short walk along the walls brought them to the Royal Station Hotel where they enjoyed an excellent tea.

Ladies Millinery Display

On Thursday morning a millinery display by Constancia of St. Nicholas Street, Scarborough, was staged in the Ballroom of the Royal Hotel. Sixty-six hats in all were paraded; these ranged from the very reasonably priced to the rather more expensive creations from Constancia's model department.

This friendly and informal gathering was thoroughly enjoyed by all the ladies and some were even tempted into buying the hats that had been so attractively modelled.

Display of Flower Arrangements

The ladies' social programme got off to a good start on Tuesday morning. Gathering in the Mirror Room of the Royal Hotel the ladies watched a display of floral arrangements by Mrs. Elizabeth Murdoch of the well known Scarborough florists, Louise. As an international judge and demonstrator in the art of floral arranging, Mrs. Murdoch has visited many countries. The audience were entertained with amusing descriptions of her travels and also learned a little about the variety of flowers which would be used in arrangements in different parts of the world. A number of colourful arrangements were demonstrated and in the hands of an expert it was made to look all too easy. At the end of the demonstration the ladies were able to question Mrs. Murdoch more closely about her work. All agreed it had been a most enjoyable morning and many left determined to be a little more adventurous with their own flower arranging.

Social Visit to Riveaulx Abbey

On Thursday afternoon a small party drove in hazy sunshine through the Vale of Pickering and Thornton Dale, with their charming villages of golden stone houses with warm red roman tiled roofs. Just beyond Helmsley the coach turned down a very steep winding hill to Riveaulx Abbey which lies in a lovely deep wooded valley by the River Rye. The ruins were beautiful and it was unbelievably peaceful, not a sound except for a robin singing and the cooing of pigeons high up in the arches of the Abbey. After wandering round the ruins for some time the party drove back to Helmsley where they had tea at the Feathers Hotel before returning to Scarborough.

Solid Smokeless Fuels Federation Golf Competition

A wonderful afternoon was enjoyed by 32 competitors who entered the Golf Competition played at the Ganton Golf Club situated on the outskirts of Scarborough. The weather was delightful and some very good scores were returned despite the difficulty of the course including the 107 bunkers, some of them so big and so deep that a meticulous count of the competitors had to be made at the end to ensure that they had all returned. I have played on quite a few courses but this is the first time I have seen a bunker with three sets of steps reaching down into it.

The winner was Mr. K. Parkin, the Deputy Chief Public Health Inspector from the County Borough of Wigan, with a Stapleford score of 36 points, a very good score when one realises that he had never played the course before. His cup and tankard were presented at the Conference Dinner and Dance by the Mayor of Scarborough, Councillor Miss I. C. Slarke. The prizes to the runners-up, Mr. R. Lord, Deputy Chief Public Health Inspector, County Borough of Luton, and Mr. I. B. Anderson, Sanitary Inspector, Burgh of Port Glasgow, were presented in the Clubhouse by the only lady competitor Mrs. J. Ireland. Mrs. Ireland is quite certain she would have won the competition if the men had let her play from the ladies' tees. Even so she looks forward to playing again next year as do all the other golfers.

Tennis and Squash Tournaments

Representatives from both Industry and Local Government turned out to play either tennis or squash at the Scarborough Lawn Tennis Club, Filey Road—and a few die-hards attempted both. The weather was fine after a poor start to the day and playing on a nine game apiece basis, the tennis proved most enjoyable, especially on the grass centre courts. Derrick George, Deputy Chief Public Health Inspector to the Hinckley Urban District Council, once again managed to defeat allcomers.

There were a few games of squash but lack of time did not allow a proper tournament to be arranged.

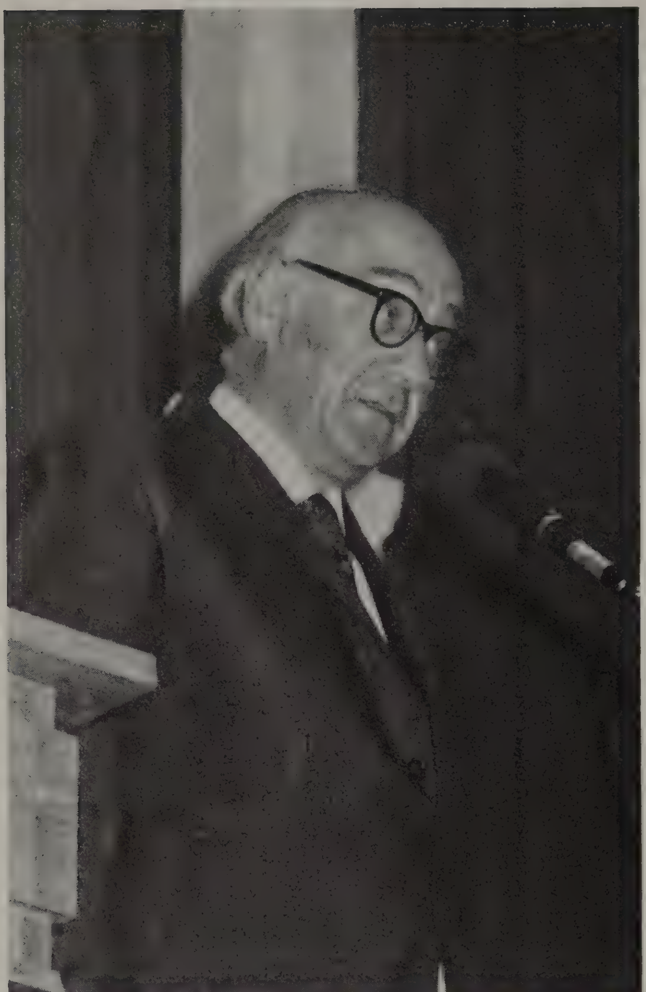
SCARBOROUGH CONFERENCE

Opening Address

by

Lord Kearton O.B.E. F.R.S.

Chairman of Courtaulds Limited



Mr. President, ladies and gentlemen, I actually feel a good deal of diffidence standing here. When everyone is introduced as being well known, you can guarantee that 90 per cent of the audience say "Who the devil's he?", but I am reminded really by the President's invitation, of the man who went to a better tailor than he normally went to and he had a suit which worried him a little bit, because it was up on the right shoulder, trailing on the left leg, didn't fit round the waist, and so on. He complained to his tailor, but the man said "You're not used to a good tailor, nothing wrong with that suit it's absolutely perfect. In any case, within a little while you will get used to it". The man went out, two of his friends saw him and one said "Look at poor old Joe, he's become a terrible cripple," and the other said "Yes, but by Jove, he's got a good tailor."

I think I am being fitted into this role of opening the conference in the same way as that chap was fitted into his suit.

The National Society for Clean Air, which many years ago, 1899, was the National Coal Smoke Abatement Society, has seen a great many improvements in the last few decades. It set me thinking, that although not quite as old as the Society, I have seen quite a few improvements too.

I was born in the Potteries, and brought up there for the first eighteen years of my life. Now the chief products of the Potteries in those days, were beautiful, beautiful pots and smoke. We had more post cards showing the smokey potteries than we had pots leaving the potteries. This was because we then had the famous "bottle" ovens or "bee-hive" ovens, coal fired. We had tile works, we had brick works; we had to make the sort of Staffordshire blues which require a reducing atmosphere and massive black smoke. The pride and joy of most potteries people was the three days in the year when you could see across the street: and all that has changed. Now we have electric kilns and gas fired kilns; and though I would not say the Potteries is a beautiful place, it has greatly improved.

I began work at Billingham, which is not too far away from here, in County Durham, and being young and impressionable, I was very mesmerised by the wonderful technological achievements which Billingham represented in those days, nearly forty years ago. Looking back, we made fertilizer and we made grit. The small village of Haverton Hill finally had to be virtually abandoned because of the grit which Billingham plentifully bestowed upon it. We made nitric acid, and I still remember, I could always tell if I had cut myself shaving, because when I went in past the nitric acid plant, the slightest cut and you felt you were being tortured by the acid which gently dripped on to it.

We made ammonia. In those days we worked eight hours with very few breaks; you had your sandwiches at the machines, and ammonia flavoured food was a common place thing with me for some years. We had coke ovens, spectacular, steamy and smelly. We made phosphatic fertilizers; we used to do plant balances on the fertilizer plant and it was a proud day when more than half the fertilizer actually came out in a bag instead of going up through the stack in fine particle emissions. We started to make titanium dioxide there, by way of British Titan Products, and that again was a very spectacular plume and dust maker

which spread its products liberally over cars and vehicles nearby; and we made cement, which is well known to everyone; and we pioneered, I think in this country, the cooling towers which are now common place at all power stations. But the one we put up in 1933, or whenever it was, was very small and its water spray went over a main ring road, and every winter it was one of the best skating rinks for miles around. Well, this was Billingham. It was a technological triumph and it was a very exciting place in which to work; but looking back it really was rather messy, and one of the conference papers by Mr. Whiteley gives some figures and graphs to show how dramatically Billingham has improved as a chemical works. I notice he starts around about 1965/67, which is just as well because if he started back in 1933 he would have required a very large piece of paper to show the heights from which it has descended to the present acceptable situation.

When I left Government service after the war, and joined Courtaulds, the firm made viscose, and smelly by-products of hydrogen sulphide and carbon disulphide came from the viscose process. One of my own first jobs with Courtaulds was to help devise processes which reduced these two effluents, and I am very pleased that one of Courtaulds' senior technologists, Mr. Jones, has a paper in the conference showing what has been achieved in the Courtaulds viscose fibre processes. We also have sulphuric acid plants, and these have been progressively improved. We are just building yet another very large sulphuric acid plant and this will have emission figures which are so low as to be almost unbelievable. I think Mr. Ireland's paper brings out some of the great advances made in sulphuric acid emission control.

One of the other things which Courtaulds makes, though not in this country, is wood pulp, and the manufacture of wood pulp can be a process which gives difficult effluents both gaseous and liquid. When I was in South Africa I saw the two pulp mills which we built with the idea of minimising pollution, and I think it is reasonable to say they are probably the cleanest pulp mills in the world.

One of the part-time jobs I have had for many years is in connection with research in the electricity supply industry; a great deal of work was done in the fifties and early sixties on how to minimise emission of grit from power stations, and how to minimise the fall-out from power station chimneys. One sees the results of the work done by a great many people in the present design of the big power stations which now dot the country. We have very tall chimneys, usually 800 or 850 feet high. We have very high plume velocity. If you have a four boiler station, inside the big single stack you have four separate stacks, coming up to give the appropriate high plume velocity at the top. The result of this, again I think it is touched on in Mr. Ireland's paper, is that the sulphur dioxide fall-out from power stations is being tremendously diluted. The grit fall-out has been almost eliminated by vast electrostatic precipitators. The fly ash, which comes from burning pulverised fuel, is handled in such a way that you get no emission of fly ash to the atmosphere. So I have seen in my lifetime great advances.

I have also been lucky enough to have been connected with the nuclear industry for some years, and I think that there has been only one really noticeable emission in this country, and that was the Winscale accident of 1957. Apart from that accident, and I think it would be very difficult to have a similar accident again, the record of the nuclear industry has been extraordinarily good. There has been so much worry about the risk that it has probably been made one of the safest industries of all.

Then, what is perhaps the most dramatic development I would say, in ordinary living, is the way in which London and other cities have been cleaned up. In the cleaning up of London, your President has played a noticeable part. Those of us who use London a good deal have seen the buildings progressively degrimed. Whitehall is now beginning to live up to its name of "Whitehall"; and all or most of the great Government buildings have been cleaned, and they are standing forth in glorious freshness. One sometimes wishes that the ruminations which go on inside lived up to the facade of the buildings.

In travelling around, one has seen the way in which cities like Pittsburgh have been dramatically cleaned up; one has seen the problems which cities like Los Angeles have had with smog and the still continuing efforts to clean it up.

The Mayor referred to the railways; railways used to be tremendously dramatic with all that steam, and all that smoke and all that dirt. Anyone going through the tunnels approaching London knows the results of it all. But after a hundred years, today's railways are immeasureably cleaner. The way in which our ordinary domestic life has improved was brought home to me this summer, when, with my wife, I visited the famous old Norman abbey at Fontrevault where they really have a complete Norman kitchen more or less as it always was. It is an octagonal building, rather like the abbot's kitchen at Glastonbury, with something like sixty chimneys, which are really holes in the roof—no flues. So all the cooking was done in the open, either in the midde or in individual bays. When one considers the contrast with a modern kitchen, I think that what was achieved was marvellous, but from the point of view of living, certainly not convenient.

So we have made progress, and your Society has been very instrumental in seeing to these improvements over the last few decades. But we now come to the question "Are the improvements we have made enough"? Well, this is really dealt with, I think, in Mr. Ireland's paper which, if I may say so, I thought was very balanced. Mr. Ireland makes great play with that wonderful phrase, "the best practicable means", and Professor Stairmand in his paper goes into some of the subtleties of best practicable means. They both bring out the fact that technology changes, technology improves; and by having the appropriate balance between technology and acceptable cost, we can make still more improvements in years to come.

We have all been reading, in recent years, recent months in some cases, of the dangers of metal contamination in the atmosphere. Mr. Fish's paper deals with this very comprehensively, and he brings out, I think, the point that while there is need for continued

vigilance, there is no need for undue alarm. I think the quite exceptional troubles with the lead emissions in South Wales should not prevent us realising, that on the whole in this country, metallic contamination of the atmosphere from industrial processes is pretty well controlled.

The new pollutant, or rather the pollutant which we now all begin to realise is a pollutant, is motor car exhaust, motor car effluent. Not only is it a major source of lead, but it is a source of nitric oxide, a source of unburned hydrocarbons; and these unburned hydrocarbons react with the ozone in the upper atmosphere to give rise to all sorts of undesirable secondary products, leading to smog, which in turn leads to throat and eye irritations and so on. So with America taking the lead, and I think they have been pushed into this by what has happened in motor car cities like Los Angeles, one of the developments of the next decade, without doubt, is going to be better control of motor car emissions. It is both an economic and a technological question, but I think the position will be very much better in the next four or five years. The technical questions are not completely solved, but most of the people directly concerned are sounding much more hopeful.

I hope someone gets on to diesel emissions, because like most motorists, one of the ultimate nuisances is to be behind a big lorry going up hill, belching forth black smoke right into one's car.

So, we come to the conclusion we can improve on present standards; it's a question of best practicable means, and the balance between what we want and what it costs.

I would like to turn briefly to the question of growth. It is very much a subject of debate at the present time. Have we got too much growth? Have we got enough growth? Should we in fact, start moving backwards?

It may be worth while recalling that historical societies—that is to say all the civilizations which we know—have been examined; and making pretty broad assumptions, the conclusion has been reached that the income per head, average product or value per head, varied between £20-£100 per year. Quite a narrow band really for all sorts of different civilizations. And what changed all this was the Industrial Revolution. In Britain, over the 200 years or so since the Industrial Revolution we have increased the national wealth 100 fold. We have not increased 100 fold per head because, of course, we have had quite a reasonable increase in population. But there has been a massive increase in wealth per head, and our society is richer than any of the known civilizations. But although we started the Industrial Revolution, and although we started, to a certain extent, the pollution that went with it—just as I think that we were one of the first to tidy up the aftermath of the Industrial Revolution—the people want more, and many societies, contemporary with our own, have more. Very roughly for instance, the wealth of the United States per annum is £2,000 per head: West Germany about £1,500 per head. France about £1,300 per head: Austria, £950 per head: the United Kingdom £900 per head. It is one of the great developments of the last two decades, that from being in the first two or three, the United Kingdom wealth per head is now only just in the first 20.

The average growth of wealth in the world today is running at about 5 per cent per annum. The United Kingdom has been stuck historically at around 2.3 per cent per annum for 200 years. 2.3 per cent per annum does not sound very much, but it does mean that you get a ten fold increase in about a hundred years; therefore you get a hundred fold increase in 200 years. But other industrial societies have been doing very much better. Japan, more than 10 per cent per year for two decades; Germany and France, more than 6 per cent for more than two decades. It is because of their very much greater growth rate, that although they started behind us, so many countries have now overtaken us. So that when we talk about growth in the United Kingdom context, I think we would find it difficult to persuade the electorate, that is the people of this country, that we do not need growth. There are, of course, very prominent advocates of zero growth or slowed down growth; we have people like Professor Forrestor, we have the American Professor Meadows, who produced a well known book a few months ago published by the body known as the Club of Rome. They pointed out that if you made exponential extrapolation then the world was on a catastrophic course, and would out-grow its resources within about 50 years. They pointed out, even if their estimates of what was available to be exploited in the world were under-estimated by a factor of ten—which is quite a big margin of error—the world would still run out of resources in about a hundred years. They therefore gloomily forecast catastrophe and say we should halt growth almost at once. These arguments have been bitterly attacked. They have been attacked in this country by Professor Beckerman of the London School of Economics; they have been attacked by Herman Kahn, the famous futureologist of the American Hudson Institute; and I personally feel that the counter attacks by Beckerman, Kahn and others, are well based. Essentially, the opponents of the prophets of doom point out the fallacies of exponential assumptions without feed backs. If anything is being used up increasing at a steady percentage rate per annum, then clearly the thing starts to accelerate, and you can very soon reduce the thing to absurdity. If I can digress for a moment. Some ten years or so ago, in considering the growth of the use of electricity in this country, the people closely concerned with the industry looked at the historical growth, which was that the demand for electric power more or less doubled every eight years, and they continued to extrapolate this. And back in 1963, Lord Hinton pointed out that it was a terrible assumption, because if you continued the curve it meant that by 1975, which is only three years away, we would be making so much electricity there would be no room for any other possible kind of energy. The growth did not happen. The growth rate fell away very sharply and the future growth rate of electricity is going to be very much less, it seems to me, than it was in the 80 years from 1884 to 1964.

Similarly, when the prophets of doom take present consumption figures and the way in which they have been increasing over the last few years, their feeling that this will go on, that it will continue to accelerate and double every few years, will not, I think, be borne out by what happens in real life.

But, coming back to the United Kingdom: we must have growth. Mr. Heath feels very strongly about this: Mr. Barber feels very strongly: the Conservative Cabinet

feels very strongly we must have growth and they have chosen 5 per cent. The Trades Union Congress have been saying for some years now that they want growth: and everything they want for their members can be achieved with growth. The figure they have chosen is 6 per cent.

When George Brown got out his famous plan in 1964/65, he thought 4 per cent might be possible. Mr. Crossland, who I suppose is the current thinker of the Socialist Party, plumps for 5 per cent growth. I have kept on hammering at this 5 per cent growth, because it is more than twice as fast as we have achieved in any sustainable period over the past 200 years. Therefore, if we do get this growth and everyone seems determined that we shall get it—it will be a very major break through for this country.

I think that the argument for growth, is that without it we are not going to satisfy the better life expectations of the great mass of people in this country, and without it we are not going to control inflation.

Nobody is really quite sure what is causing the present type of inflation. The facile remedies of economists do not seem to be clicking into gear. But I suppose there will be more agreement on this than on anything else, that it could be brought under control by growth dependent on productivity. This view is accepted, by the way, in my own experience, by the senior Trade Union leaders; it is accepted by the Government; it is accepted by industry, and therefore there is a chance that we shall make this dramatic breakthrough and get growth of 5 per cent per annum for some years resting on productivity gains. If we do not get this growth, then we all know that inflation will run riot. Inflation hits hardest the pensioners on fixed incomes; it hits hardest on the thrifty who are savers of money. It means that things like National Savings Certificates, Post Office Savings, Trustee Savings Bank deposits, Building Society deposits, without profit insurance payments, and so on—all these money savings, which are essentially the savings of the small man, although in total enormous, really start vanishing like the wind. For anything like this to happen on any scale in this country, opens up vistas of real catastrophe. And so we must have growth in the United Kingdom. I think the obvious point, because if you read the financial press you might not think it is so obvious, is that the growth we want is industrial growth, output of goods.

Although services will increase as our economy matures our vulnerability in the last two decades has been our too low output of goods. Most of our major manufacturing industries have been in trouble, steel, coal and many other major industries, and we must do something to raise industrial growth of the fundamentals. I personally feel we can do this by taking a leaf out of the book of other developed nations, by industry working more closely with Government and the Trades Unions. And the developments of the last few months would imply that the present administration has come to that conclusion too.

Now if we are going to have this growth, will it harm the environment? The obvious answer is, "It could, but it need not".

Today's awareness and today's technologies allow growth plus an improving environment. We must take note that additional costs will be involved in improving environment at the same time as improving growth, and these additional costs in the free world would require monitoring. It raises the sort of question—"Should cheaper products from pollution-ignoring countries which do not have the anti-pollution cost, be allowed to disrupt domestic economies?" I think the answer is "No". You may think I am conditioned to say this because, being in the textile industry, we have had rather severe experience of the disruption that cheaper products coming into this country can make on the country's industries and employment.

In a recent supplement in one of the national papers, it was pointed out that towns such as Rochdale and others were able to adjust for a time to the reduction in employment caused by the decline of the textile industry, but it had now reached the point that quite a small reduction in textile employment built up the unemployment in textile towns to quite unacceptable levels. While, like everyone else, we like to help the third world, the question to what extent you can condone, or live with massive disruption of domestic economies, is something which requires watching.

One day, on a world basis, growth must tail off. As I have said, exponential growth does not go on for ever and the tailing off of growth will happen by feed back mechanisms and adjustments. But our contribution as a country to the third world, our contribution and our voice in world affairs will be based, as much as anything else, on our economic status; and our economic status is what we must improve.

So if I may conclude, in this world of growth, which we want to see evident in this country, in this world of less pollution and cleaner air, which we want to have in this country, the role of the National Society for Clean Air is assured and it is vital. It has been going strong for 73 years and will continue to flourish. The attendance at the conference is itself gratifying. The quality of the papers, which we will be considering this week, is excellent.

Mr. President, ladies and gentlemen, I have the privilege and the pleasure to declare the conference formally open.

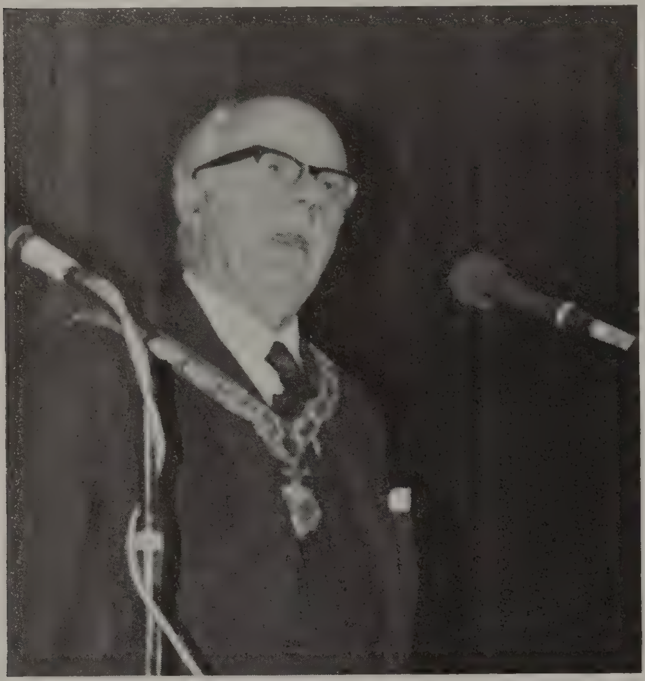
FOLKESTONE CONFERENCE

Presidential Address

by

Stanley E. Cohen, C.B.E., C.C., F.R.S.A.

My Lord(s), Your Worship, Ladies and Gentlemen, although I know that this will be done more formally later, I should first of all like to thank Lord Kearton for the splendid address which he has just given. On behalf of the Society I should like to say how grateful we are to him for opening this Conference and how glad we are to have him with us in his two capacities as Chairman of Courtaulds Ltd. and as President of the Society of Chemical Industry. We are delighted also to welcome Courtaulds into the Society as a sustaining member.



Now I do not intend in any way to impinge on what subsequent speakers at this Conference may say, but I would like to take this opportunity of commenting briefly on the Conference programme. You will see that there are fewer papers to be presented this year. This is a matter of deliberate policy by the Conference Committee; it has been done to allow more time for discussion of important matters, for that is what a conference is all about. I think you will agree that the subjects on which papers will be presented and which we shall have the opportunity of discussing very fully are, to say the least, topical and significant.

Professor Stairmand's paper I consider to be of great importance at a time when certain people would advocate that to control pollution we should put the clock back. This is something that as a Nation we cannot do; but we can increase our efforts to improve control of pollution, not only pollution of the air, but all pollution. What we have to establish is how far this Society can and should go and no doubt there will be a variety of views on this.

Everyone in this audience knows that there has been a lot of interest generated recently about lead and its effects. There has been much conflicting evidence and even more conflict in the way the available evidence has been interpreted. But lead is only one of a number of metals which are present in the air we breathe, and it is therefore right and proper that we should consider such a subject at this Conference. Mr. Fish, I know, will give us much factual information on which we shall be able to base informed opinion.

We are fortunate that Mr. Ireland, Her Majesty's Chief Alkali Inspector, will speak personally about the control of the Scheduled Processes. These processes and their control are always matters of interest and sometimes of controversy. As some of you will know, Mr. Ireland himself has been under fire recently—perhaps he may come under fire again later this week—but we know that we will be brought up-to-date about what is being done and what is possible in controlling emissions from what are often difficult processes. Perhaps among these is the chemical industry, and it is salutary that we should receive a paper by Mr. Whiteley on this important industry.

Odours seem to be coming more noticeable than they were. Doubtless this is because except in laggard authority areas there is less smoke and sulphur dioxide in the air we breathe, and therefore any objectionable smells are more apparent. Whether this is so or not, objectionable smells constitute a real nuisance and this is a subject about which we need to know much more—what causes the smells and how they can be combatted. We therefore look forward to two papers on this subject, one by Mr. Rees Jones who will deal with industrial odours, and one from Dr. Peakin who will deal with agricultural odours.

Finally, Dr. Lloyd Jones and Mr. Cowling will present papers on the effect of air pollution on vegetation and plant life. This is a subject of considerable importance and one which we may have somewhat neglected at our conferences in the past. We all probably know that air pollution does have an effect on plant life and vegetation but perhaps few of us know what these effects are. We do know for example that the increasing replacement of trees and vegetation by concrete and bricks reduces the natural re-cycling of noxious gases and thus affects the ecology.

All in all, these are subjects to excite thought and lively discussion, and I hope that delegates will not hesitate to take the opportunity of making a worthwhile contribution at the appropriate time.

Turning to the events of the past year, in the realm of clean air I am reminded that as long ago as October, 1964 I suggested to the Clean Air Council that it was time that legislation to control emissions from motor

cars should be introduced and have pursued the subject ever since. Well, it has taken eight years, but Mr. Peter Walker has recently announced proposals that by October, 1973 new cars will have to comply with the limits for the emission of carbon monoxide and hydrocarbons laid down by E.C.E. Regulation No. 15. This will apply to cars first used on or after the 1 October, 1973. The Department of the Environment forecast that compliance with this new regulation will reduce emissions of carbon monoxide by up to 30 per cent and of hydrocarbons by up to a further 10 per cent as compared with the emissions from older cars. This will be achieved by using a better engineered carburettor with closer tolerances and which has been flow-tested before production, and by closer control of ignition employing a better engineered distributor. This E.C.E. Regulation prescribes that the carbon monoxide content by volume of exhaust gases emitted with the engine idling must not exceed 4.5 per cent. This means that the engine, if submitted to the full E.C.E. operating cycle tests, would still be within the prescribed limits. The E.C.E. regulations also require a device to be fitted to cars to prevent gases escaping from the crank case; but this has already been mandatory for new vehicles registered in this country since the beginning of this year. This device, together with the new regulations, should mean a total reduction of up to 35 per cent in hydrocarbons emitted. Further, diesel engined vehicles manufactured on or after 1 October and first used on or after 1 April next year will be required to conform to the provisions of the British Standard on diesel engines BS AU 141a, which contains a strict limit on smoke emissions. It is true that these regulations do not yet go far enough. but they are a step in the right direction and I therefore welcome them. I am assured by Mr. Eldon Griffiths that they are only a start and that there will be more to come. It has indeed been a long struggle to get something done, but I am sure you will agree that it has been worthwhile.

As I have already said, there is much conflicting evidence about lead in the atmosphere; and although present levels of lead emissions may not constitute a danger to health, it is undoubtedly desirable that they should not be exceeded and should, if possible, be reduced. I. therefore, welcome the recent announcement again made by Mr. Peter Walker, of a phased programme to reduce the lead content of petrol. The maximum permitted level will be cut by almost one half over the next three years.

This is again a step in the right direction and more so because the Department of the Environment has collaborated with the Department of Trade and Industry and the oil and motor industries over it and is further collaborating with them in studying other means of controlling emissions of lead to see whether further reductions are possible in the longer term.

In the field of smoke control the figures published indicate that there has been a sharp rise in the number of new Smoke Control Areas registered in the last 12 months. Indeed, if things continue in this way, it looks as though 1972 may be a vintage year which will pass the previous peak reached in 1967. Nevertheless there are still a number of authorities who have been, to say the least, dilatory or who have only paid lip service to the national policy. In this connection it is of interest that the Minister recently appointed a panel from members of the Clean Air Council to report on domestic smoke control in the North East of the country. Their report will shortly be published. I understand that it will be given a wide distribution and I urge you all to read it. As a member of the Clean Air Council, I have been privileged to see it and can tell you that one of the conclusions reached is that smoke control is no problem if the elected members of each Local Authority have a will to act. This is nothing new, but to my mind it is still the key to the problem; if the will is there, the smoke can be abated, and it is up to public opinion in these laggard areas to make its will felt.

I have already referred to the fact that we shall be discussing odours at this Conference and I think it is significant that the Department of the Environment has appointed working parties to examine this problem. Indeed some of the speakers taking part in this Conference are members of the working parties concerned. Again, we welcome the action of the Department of the Environment setting up these working parties.

1972 has seen the United Nations Conference on the Environment at Stockholm in which 114 nations took part and as you are no doubt aware, more than a hundred recommendations regarding the environment have been made as a result. The conference has been described as one of high endeavour which explored the problems of the human environment in the very broadest sense. Although there were inevitable clashes in outlook towards the end there emerged the beginnings of a common understanding of each others' problems which may well have a highly significant bearing on the future setting of environmental standards. As Mr. Eldon Griffiths, the United Kingdom Under Secretary of State for the Environment, has put it, "the conference achieved three main objectives to which the United Kingdom delegation attached great importance. These were an agreement to take early action on ocean dumping, the setting up of a global monitoring system, and the setting up of a worldwide referral system". In all these activities of the past year the Society has played its full part. But perhaps overshadowing all this, is the reform of local government which could have a profound effect on the Society itself. As you know, clean air will be the responsibility of the new districts. Some of these new districts are already members of the Society; others are not. Some local authorities who are members will disappear; others will be absorbed. It is therefore vitally necessary that all the new district councils should become members of the Society. The Society will have an even more important role to play in the future in providing a bridge between central government, industry, the local authorities responsible for clean air and last but by no means least, the general public.

This leads me on to industry and the industrial membership of the Society. This is slowly expanding but I would like to see it expand still further. A new association has recently been formed called Environment Protection Equipment Manufacturers (EPEM for short). This is an association of firms whose title is self-explanatory. They have sought help from the Society in the formation of the association which will not only look after their own interests which is only natural, and to co-operate in the Society's work, but to set standards for operating procedures, standards for equipment, and the like, and to make this new industry better equipped in an expanding export market.

This is another step forward which we have helped to promote in the past 12 months and about which I am personally very gratified, since it is an object I have had in mind for some time.

Every year, each conference indicates to me that more and more there is a necessity to consider the environment as a whole. And as I read the various books and journals on the subject, I find that others, perhaps more qualified than myself, are of the same opinion. This has been emphasised in 1972 by the United Nations Conference at Stockholm. It has been highlighted, too, by the number of conferences and exhibitions which now cover the whole field of the environment and in which, I am glad to say, the Society is playing its part. But I suggest to you that the time has now come when we must consider very carefully and seriously the possibility of extending the Society's activities into other fields of the environment. Air pollution is only one part of the whole; pollution of the air and its control can have effects on pollution of water and pollution of the land, as, on the other hand, polluted water can affect the air we breathe. It is therefore increasingly apparent that the problems associated with air and water cannot be solved by the specialist in one discipline but the Society could co-ordinate the two. This does not mean that we should abandon clean air; far from it, we must remain *the* authority on that, but we can extend our terms of reference to use the expertise and goodwill which we have built up over the years, nationally and internationally, to wider fields for the good of mankind in general and the British nation in particular.

THE INTERNAL COMBUSTION ENGINE AND POLLUTION

Clean Air Spring Seminar, Oxford

Tuesday 3 and Wednesday, 4 April, 1973

A residential two-day seminar will be held in Oxford on 3 and 4 April. Technical sessions will be held in Magdalen College School Hall; accommodation and meals will be in St. Hilda's College.

The four technical sessions will deal in turn with the petrol engine, the diesel engine, the jet and gas turbine and a look at the future of the internal combustion engine.

The charge, which is inclusive of accommodation for the nights of 2 and 3 April, all meals, preprints of papers and the report of proceedings, is £20 per head.

A brochure giving details is available on request from the Society's offices at 136 North Street, Brighton BN1 1RG (tel. 0273-26313).

Reader Enquiry Service No. **7298**

AIR POLLUTION MONITORING UNIT

Chemical Defence Establishment, Porton Down, Salisbury, Wilts.

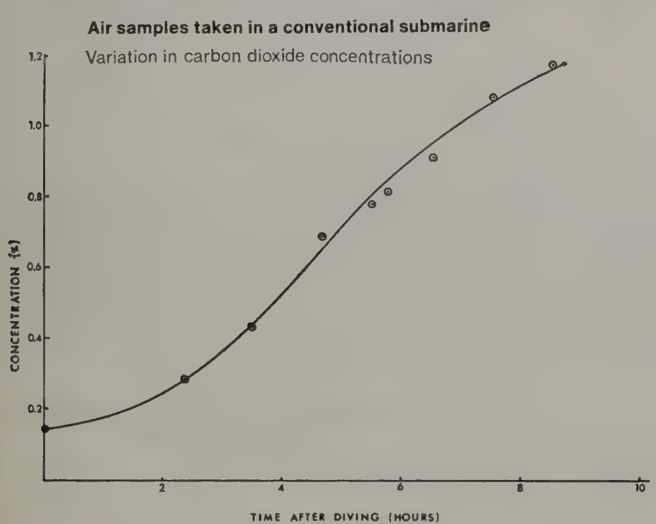
This article is published in Clean Air by the kind permission of the Ministry of Defence.

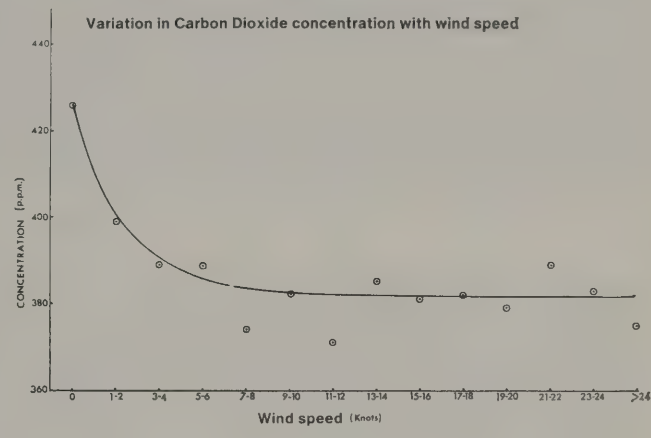
This laboratory has been equipped to identify and monitor all gaseous atmospheric pollutants rather than a selected few.

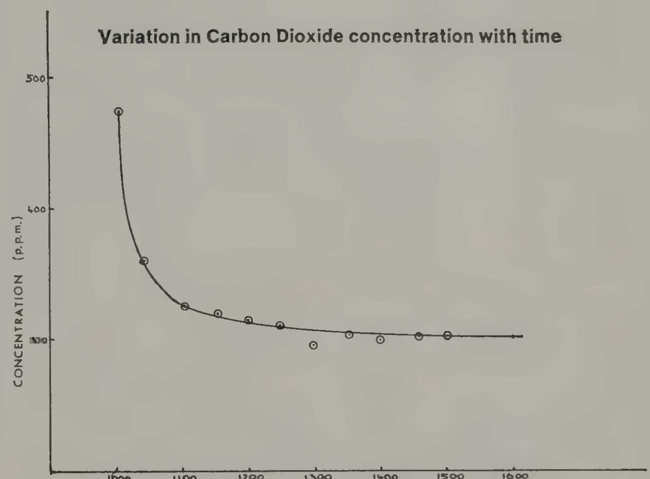
For pollutant concentrations down to one part in one hundred million (1 in 10^8) infrared spectrophotometry, quadrupole mass spectrometry and gas/liquid chromatography will be used. For lower concentrations pollutants will be absorbed and later examined at C.D.E. by a gas chromatograph—mass spectrometer—computer system. Solid pollutants will be collected and examined for heavy metals.

Using impervious plastic containers contaminated atmospheres inaccessible to the analytical equipment can be sampled and transferred to the laboratory for examination.

Examples of this type of application are the analysis of air in aircraft cabins, in submarines, inside vehicles and at selected spots in and around factories. The following graph illustrate the application of this sampling technique to the analysis of submarine atmospheres.





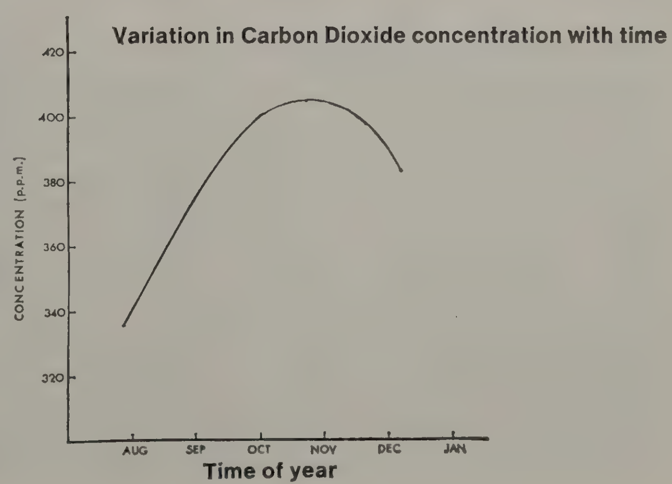


By sampling the atmosphere at a single site for an extended period it is possible to monitor the variation of pollutant concentration with the time of year, time of day, wind direction, wind speed, etc. Typical results from rural Wiltshire show the variation of carbon dioxide (CO_2) concentration with wind speed, time of day and time of year.

High winds mix the low concentrations at high level with the high ground level concentrations to give constant average.

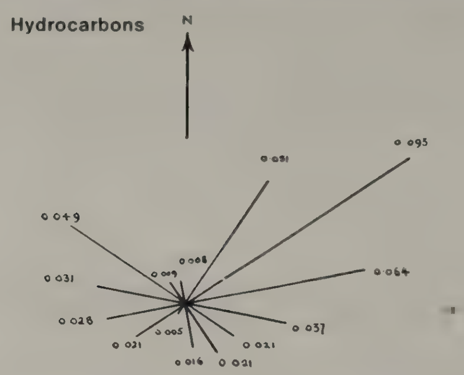
In daylight CO_2 is used up by plants and concentration falls.

In winter plants are less active and use less CO_2. Also more fires make more CO_2.



Other pollutants, if locally generated, will be at higher concentrations if the air sampled has passed over the source of pollution. For pollutants of general origin the concentration will be largely independent of wind direction.

This is illustrated by "pollutant roses" showing variation of concentration with local wind direction.

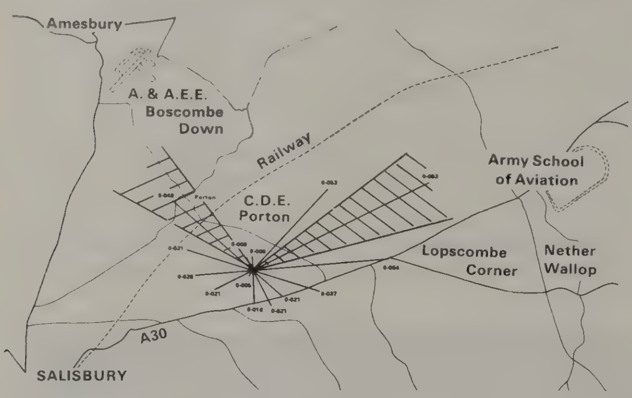


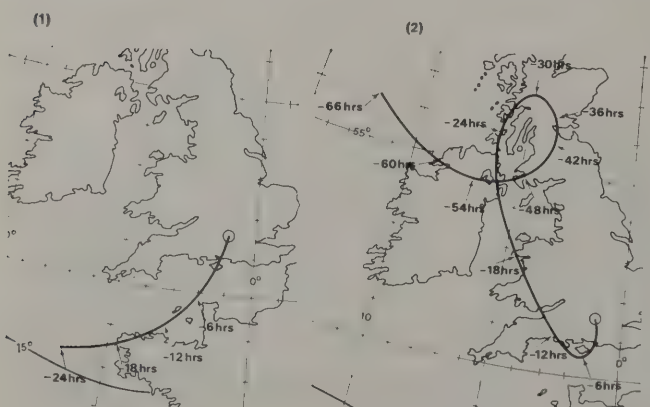
Variation in hydrocarbon concentration (p.p.m.) with wind direction

Produced by specific sources

Sometimes the source of pollution can be traced from the direction of peak concentrations. Transferring the "pollutant rose" for hydrocarbons to a map of the locality reveals—two aerodromes!

This approach is useful for local sources of pollution but can be misleading for long distance travel as shown by the two plots of the past history of two locally identical winds.



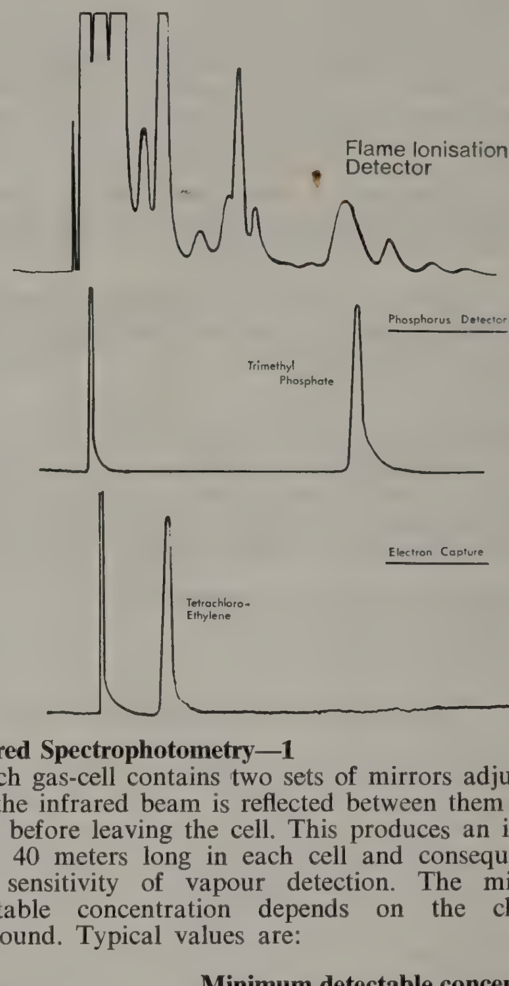


Mainly over sea

Industrial areas of Severn, Mersey and Clyde

Gas Chromatography

Atmospheric pollutants are separated according to their volatilities by partition along a column between gas and a liquid phase. From the time each pollutant is retained on the column, and the relative responses of a group of selective detectors, partial identification of pollutants is achieved. This gas chromatograph is set up to monitor organochlorine and organophosphorus pollutants by use of detectors having selective responses to chlorine and phosphorus as shown on the chromatogram.



Infrared Spectrophotometry—1

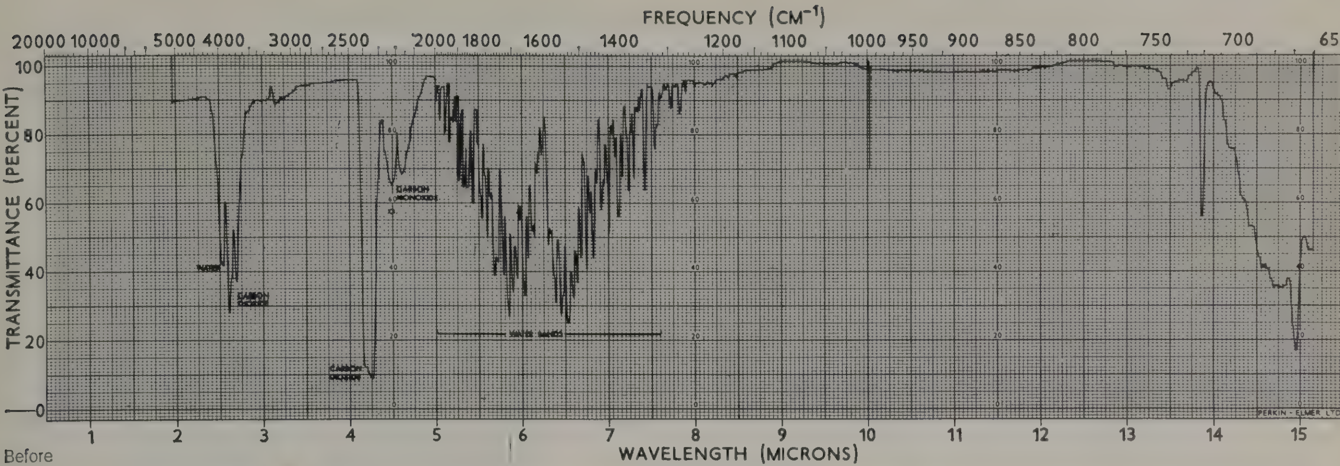
Each gas-cell contains two sets of mirrors adjusted so that the infrared beam is reflected between them several times before leaving the cell. This produces an infrared beam 40 meters long in each cell and consequently a high sensitivity of vapour detection. The minimum detectable concentration depends on the chemical compound. Typical values are:

Compound	Minimum detectable concentration parts per million
Nitrogen dioxide	0.01
Acrolein	0.02
Sulphur dioxide	0.03
Ozone	0.05
Ethylene	0.10
Methane	0.3
Carbon monoxide	0.8
Hydrochloric acid	7.0
Hydrogen sulphide	50.0

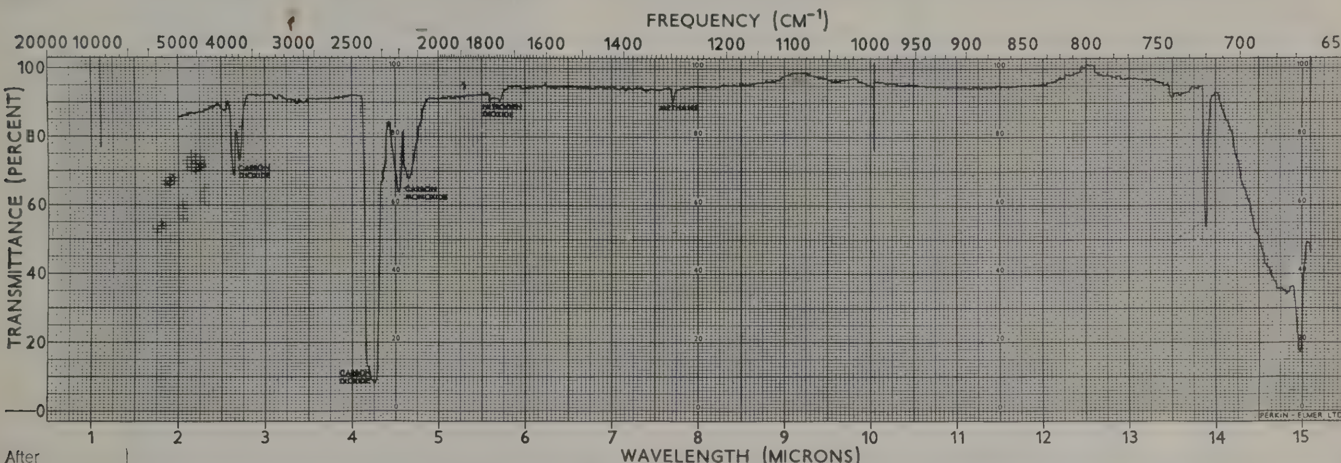
Infrared Spectrophotometry—2

Infrared radiation is absorbed by all compounds. The main absorbers in "clean" atmospheres are water vapour and carbon dioxide. So that other gases can be detected in the presence of water vapour its absorption is cancelled by the reference cell.

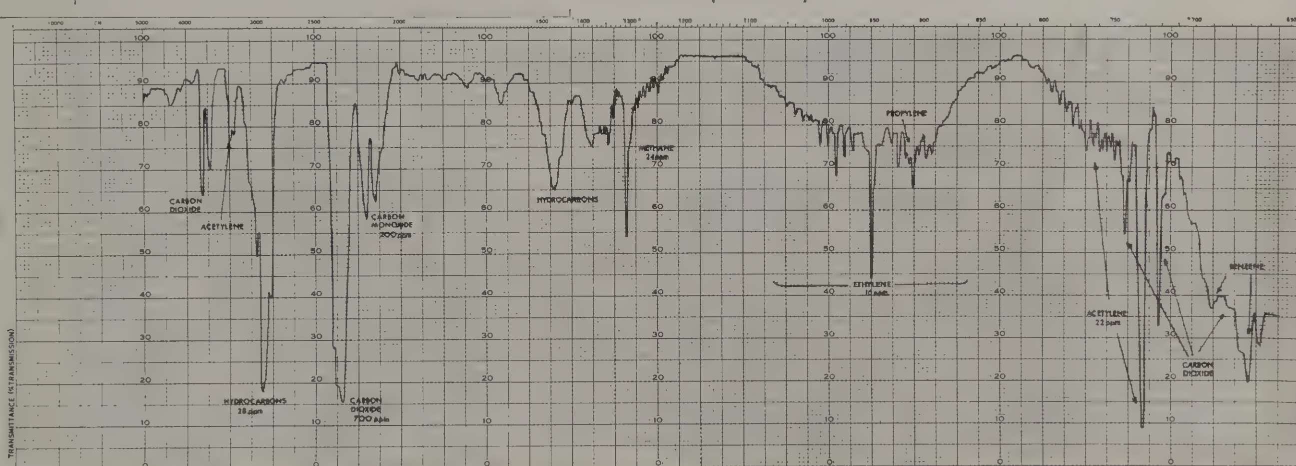
In the infrared spectrum the position (wavelength) of an absorption band identifies the compound. The band intensity indicates the amount present, as illustrated by these spectra of diluted vehicle exhaust gases.



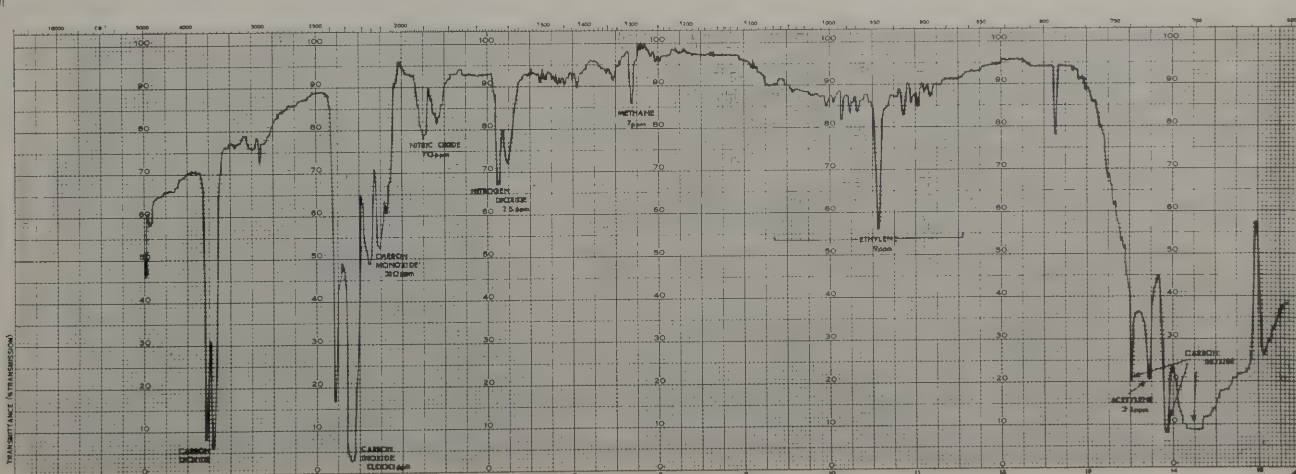
Before



After

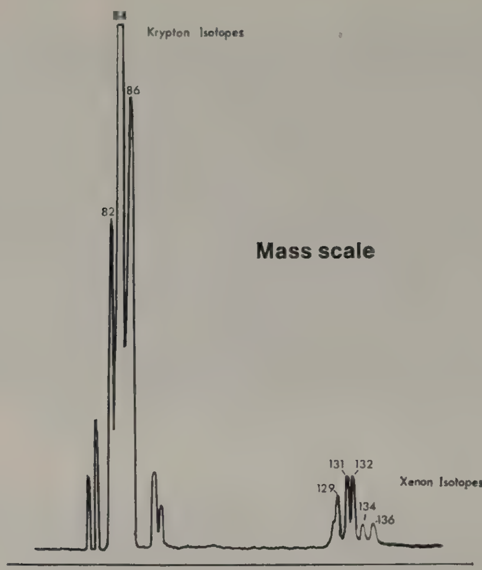


Petrol



Diesel

D



Quadrupole Mass Spectrometry

The atmosphere is sampled through a thin diaphragm into the low pressure of the quadrupole. Pollutant molecules are ionised and then separated in order of their masses by the quadrupole field. This is a very sensitive method of identifying pollutants.

This mass spectrum shows atmospheric concentration of krypton (1.14 p.p.m. total) and xenon (0.087 p.p.m. total). The atmospheric concentrations of individual xenon isotopes are:

Mass	Concentration p.p.m.
128	0.002
129	0.023
130	0.004
131	0.019
132	0.023

ROAD VEHICLE EMISSION TESTING

Newcastle upon Tyne

The National Society for Clean Air have continued the series of tests started in Brighton during 1971, with two days, 27 and 28 September, spent in Newcastle upon Tyne testing 390 petrol engined vehicles.

At that time there were no prescribed standards in force in this country to limit the pollutants emitted from petrol engined vehicles. However, regulations came into force on 7th December, 1972, to the effect that by November, 1973, most new petrol engined vehicles will have to comply with the limits for the emission of carbon monoxide and hydrocarbons laid down by ECE Regulation No. 15. This regulation states that the carbon monoxide content by volume of the exhaust gases emitted with the engine idling must not exceed 4.5 per cent.

The instrument used in Newcastle upon Tyne was the Olsen-Horiba Mexa-300, CO/HC Analyzer, distributed in this country by T.E.M. Sales Limited of Gatwick Road, Crawley, Sussex. The Mexa-300 is a double beam, positive filter type non-dispersive infrared analyzer incorporating a complete sampling system, with individual read-outs of both carbon monoxide, scale 0-10 per cent, and hydrocarbons, scale 0-1,500 p.p.m. The top of this portable analyzer (weight 25 lbs.) is shown in the accompanying photograph. The Society would like to thank Leslie R. Towndrow, a member of the Technical Sales Department of the distributors, for his valued assistance.

Our thanks should also be given to the Northumberland Police Authority for the help of the two police constables in directing the necessary traffic to the testing centre.

As has been said, 390 vehicles were tested, of which 144 or roughly 27 per cent were emitting 4.5 per cent or less carbon monoxide of the total volume of exhaust gases. This figure confirms the results from earlier tests. Older vehicles with low carbon monoxide content are suspect as a number of them had well ventilated exhaust systems! Of the vehicles tested which were registered after 1 August, 1971 nearly twice as many emitted more than 4.5 per cent carbon monoxide as the number who emitted less. There is an equal spread of vehicles registered after 1 August, 1972 both above and below the continental limit of 4.5 per cent, i.e. 10 above the limit and 10 within the limit.

Drivers were generally very co-operative and many were anxious for more information on how to reduce exhaust emissions from their cars.

Several drivers came back for a second test, after adjusting the carburettor settings and in all cases a great reduction in carbon monoxide and hydrocarbon content of the exhaust gases was indicated.

VEHICLE EXHAUST TESTING—NEWCASTLE, 27th & 28th SEPTEMBER 1972

Year of Reg. or Reg. letter	.5 or below	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	Over 10	No. of Cars
1959 and before			1											2		3		1		1	2	10
1960							1		2			1	1			2						7
1961									2									1		1		4
1962						1			1			2	1				1	1		1	2	10
A		2					1	2		2	1			2		2	1		1	2		16
B	2	2	1	1			1		1			1		1	1	2		1		1	3	18
C	3	2			2	1		2	1	3	1	3	2	1		1					4	26
D	2	1		1		1	3	1	1	2	3	3	1	2	3	1					2	28
E	1		1	1	1		1			1		2	2	3			1	1	1	2	2	20
F	2	3	2	1			1	1	1	1	1	3	1	3	1	2	1	4		1	1	30
G	3	1	1	1	1	1	2		1	2	2	2	1	3		5		2	2	1	2	33
H		2					1	4	5	2	2	6	2	2		6		4	2	2	1	40
J	3	3	1	3	1	3	8	6	4	3	3	5	2	4	2	5		1		1	3	60
K	1	4	1	1	4	2	3	2	3	4	10	7	2	5		5		3	3	3	5	68
L		1	1	1				6	1		1	2		1		3	1	1		1		20
Totals	**17**	**21**	**9**	**10**	**9**	**9**	**22**	**24**	**23**	**20**	**24**	**37**	**15**	**29**	**8**	**36**	**5**	**19**	**9**	**17**	**27**	**390**

Similar tests took place in Birmingham during the Summer.

Left: The Mayor of West Bromwich's car being tested.

BONFIRES: STRAW & STUBBLE BURNING

Each year the Society receives a number of complaints about air pollution. As might be expected these complaints vary enormously from those about emissions from large industrial plant on the one hand to those about the domestic garden bonfire on the other. By far the greatest number of such complaints are about garden bonfires.

Again, the way in which the complaints are framed varies enormously. At one extreme is the householder who suggests that his neighbour has a bonfire burning 24 hours a day for 365 days a year for no other purpose than to annoy the complainant. At the other extreme is the reasonable householder who writes to ask if there is anything that can be done to avoid causing annoyance to one's neighbours. But by far the most letters that we receive want to know why it is that bonfires are not banned under the Clean Air Acts and "can't we do something about it".

This latter type of letter is particularly difficult to answer properly because there is very little that we can do about it, although for some considerable time we have been trying to do just that. However, it is unlikely that it will be possible to introduce any form of legislation forbidding domestic bonfires until such time as the community as a whole provides other means for the disposal of rubbish. A few local authorities are prepared to collect garden rubbish along with household rubbish in the ordinary way; some others are prepared to take away garden rubbish for a small charge. But unfortunately, the majority of authorities are not yet geared to deal with the problem in this way.

Much can be done by suggesting to householders that they should compost the rubbish from their gardens but even so there will be certain large woody pieces such as arise from the pruning of rose bushes and trees. These still have to be got rid of and, perhaps unfortunately, burning is the obvious way. But if a few simple rules are applied, such bonfires need not cause a nuisance to either the householder himself or his neighbours. The ideal should be for a hot, quick fire burning dry garden rubbish which is not easily compostable. The fire should not be left unattended, and on no account should any garden fire be allowed to remain alight later than one hour after sunset. The rather cynical rule of "Don't light a bonfire if the smoke is going to blow into the house" should be interpreted as "Don't light a bonfire if the wind is going to cause the smoke to be a nuisance to anyone".

In the meantime, the Society are continuing to encourage local authorities to help householders by the collection of garden rubbish. It will be a long time before this facility is extended to the whole country, but there are already signs of more authorities doing this and the changes that the reform of local government will shortly bring about should help to speed up the process.

Perhaps allied to garden bonfires is that of the burning of straw and stubble after harvest by farmers. This is a practice which seems to have increased in recent years and it has become particularly noticeable during the autumns of 1971 and 1972, possibly because both were particularly dry seasons. The fact that this practice gives cause for complaint is well known to the Department of the Environment, the Ministry of Agriculture, Fisheries and Food and the National Farmers' Union. Indeed at the end of last year the National Farmers' Union called a meeting of all interested parties to draw up a new Straw Burning Code. This was by no means easy as there are conflicting requirements for different interests. For example, fire precautions suggest that burning should be carried out in the early morning when there is still dew on the ground. This is at variance with the requirements of the Society which is more concerned about smoke and which would prefer that burning should be carried out under dry conditions with a hot, quick fire; and although it is recognised that it can be an offence to let smoke drift across the highway, less importance is attached to the nuisance created by smoke drifting near dwellings. The Code drawn up as a result of this meeting is as follows:

The Straw Burning Code—1972

Straw and stubble burning is often a vital aid to arable cultivations but farmers have a special responsibility to preserve the countryside, its landscape and especially its wildlife.

Care must also be taken to avoid hazards arising from sparks, as well as nuisance from smoke or smuts, to neighbouring properties, users of the highway and members of the public.

Anyone starting a fire should observe the simple precautions of the safety code.

The Code

A. Never burn:

1. *When the fire may get out of control:*
   in strong winds
   in exceptionally dry conditions

2. *In the vicinity of:*
   thatched cottages or residential areas
   farm buildings
   hay or straw stacks
   any other concentrations of flammable material
   standing straw crops
   any industrial buildings or plant

3. *Without adequate firebreaks to protect, in particular:*
   woodland, hedgerows or any wildlife habitat
   trees growing in fields
   electricity or telegraph poles
   any other public utility installations

4. Near roads where drifting smoke could be a serious traffic hazard
5. At night. This is dangerous and may alarm the public
6. On peaty soil which may catch fire

B. Special care is needed:
1. In the vicinity of aerodromes
2. Near oil gas pipeline installations
3. When burning extra large fields

C. Before you start burning:
1. Make firebreaks at least 20 ft. wide. This may be done by removing the straw and ploughing or by cultivating around the boundary and between swathes and then burning straw in from the perimeter one swath at a time. This should preferably be done in the early morning when the dew is still on the ground.

   N.B. Wider firebreaks may well be needed to protect trees and hedgerows from scorching.
2. Consult your local Fire Brigade well in advance and prepare directions to locate the site of burning in case of emergency.
3. Notify your neighbours in order to prevent unnecessary alarm when burning starts.

D. When burning:
1. Start early in the day.
2. Burn into the wind rather than down wind
3. *Put an experienced person in charge* and never leave the fire unattended
4. Have plenty of fire beaters available for use and know where you can get helpers to use them in an emergency
5. Ensure that the fire is completely out before leaving the field. Return later in order to make doubly sure
6. *Should the fire get out of control call the Fire Brigade immediately.* Meet the Fire Brigade at the roadside and show them the best way to reach the fire

It might be argued that this Code does not really concern itself enough with smoke as a nuisance and the Society have made representations accordingly. This, together with other representations, has resulted in a further meeting being called to re-examine the whole position and it is hoped that more stringent regulations will result.

These days farming is an industry, albeit a specialised industry. All other forms of industry are subject to very stringent regulations about smoke. The question that immediately comes to mind is "Why should agriculture receive special treatment?" Whilst it is probably true that stubble burning is necessary in the short term as a practical economic measure, it is suggested that the whole question of the ecology of stubble burning should be considered in the long term. Stubble and straw burning may be regarded as a method of disposal of industrial waste by incineration. The Clean Air Acts impose restrictions and control on industrial incineration. Should controls be extended to cover another large and important industry—agriculture?

Noise from M6 Motorway in Birmingham

Keith Speed, Parliamentary Under Secretary of State, Department of the Environment has announced that he has accepted an offer made by the Birmingham Corporation to make available a flat in Douglas House in Firs Estate, Birmingham, so that experiments can be carried out on methods of sound insulation.

The experiments will be undertaken by the Transport and Road Research Laboratory in association with the Building Research Establishment.

Mr. Speed also announced that, as part of the process of determining how householders can best be protected from the effect of noise from motorways, the Department of the Environment will be erecting an experimental noise barrier, about one kilometre long, between Queslett Road and Beeches Road so that measurements can be taken of the effectiveness of such a barrier. This project was proposed by the Department in earlier discussions with Birmingham Corporation.

BOOK REVIEWS

Air Pollution Control in Transport Engines
Institution of Mechanical Engineers. London. £13.00. A symposium arrangd by the Automobile Division and the Combustion Engines Group of the Institution of Mechanical Engineers 9-11 November 1971.

This well bound and indexed book of over 370 pages contains the full script of 33 technical papers presented at Solihull, Warwickshire, in November, 1971 and includes Discussion, Communications and Author's Replies.

The papers give the current views of many experts in this field from the U.K., U.S.A., France, Germany and Japan and thus represent worldwide technical thinking. There is much of interest to engineers connected with the design and manufacture of automobile engines, though the diversity of opinions expressed during discussion indicates that the subject is not yet cut and dried.

The papers are divided into two main sections covering diesel and spark ignition engines respectively. The former are concerned mainly with smoke emission though it seems that insufficient attention is given to the means to be adopted for its reduction to acceptable, invisible level.

The papers on spark ignition engine exhaust emissions range over a wider field though mainly concerned with carbon monoxide, hydrocarbons and oxides of nitrogen. The theme running through all papers is how to meet the very severe pollution limits set by the U.S. federal government for the year 1975. Insufficient evidence is given to make the point that the severity of the legislation is necessary to secure an acceptable reduction in pollution.

In spite of the practical impossibility of achieving the U.S. standards at acceptable cost, or indeed at any cost, the papers will be of great value to engine designers in meeting the more reasonable reductions in pollution emissions being sought in Europe and the U.K.

The bringing together of technical engineers and chemists from the major automobile manufacturing countries of the world was of great significance and benefit to mankind.

This is a text book of appreciable value even though there is a wide divergence of opinion on some aspects. The only criticism is that there is no paper devoted to the reasonable and practical reduction of automotive pollution as seen outside the U.S.A.

P. Draper

Reader Enquiry Service No. **72106**

Noncatalytic Auto Exhaust Reduction
Daniel Post. Noyes Data Corporation, New Jersey, U.S.A. 1972. $36.

This book deals with the subject of noncatalytic conversion of automobile exhaust gases. It describes a broad range of systems and devices in the areas of noncatalytic and thermal combustion as well as physical separation of pollutants by filtration or cyclone-type centrifugal action. Also described are chemical reactions not initiated or supported by any kind of catalyst.

The detailed and descriptive information is based on U.S. patents relating to devices and designs for converting automobile exhaust fumes into less polluting gases. Because of the actuality of the problem, many patents are of very recent date.

Reader Enquiry Service No. **72107**

Dispersion and Forecasting of Air Pollution
World Meteorological Organisation, Technical Note, No. 121. 1972.

The general discussion of Chapter one acquaints the reader with the progress in the state-of-the-art of dispersion theory and practice.

Chapter two is concerned with the height to which a buoyant plume will rise. The theoretical considerations are briefly outlined and a number of empirical formulae presented. The chapter concludes with a discussion of how to use the formula successfully.

The classical expression for diffusion is discussed in chapter three, as it relates to transport and diffusion in non-urban environments. Simplifications of this expression as it applies to moderate travel distances during steady-state conditions are then presented. Complications caused by mesoscale or synoptic-scale systems and travel over long distances are then considered. Some pollutants undergo chemical reactions or are removed by precipitation—these processes are reviewed as far as known. The chapter concludes by showing how the surface of the Earth acts as a sink and sometimes (i.e. during duststorms) as a source.

The effects of cities on the transport and dispersion of pollutants is the subject of chapter four. After a review of the urban microclimate, models for various types of sources are presented. Finally chemical reactions and removal processes over cities are discussed.

Chapter five treats the forecast aspect of meteorological services for air pollution abatement. The observations required and the forecast parameters are reviewed. Forecasting of air pollution potential is then described, followed by a discussion of forecast verification. Finally the more difficult problem of forecasting the concentration of the pollution itself is examined.

The appendix contains a detailed description of atmospheric diffusion investigations in the U.S.S.R.

Reader Enquiry Service No. **72108**

Biological Aspects of Lead: an annotated bibliography. Parts 1 and 2

U.S. Environmental Protection Agency. 1972. $6.75 per set.

The Kettering Laboratory of the University of Cincinnati, where this bibliography was compiled, was founded in the mid-20's by Dr. Robert A. Kehoe, a researcher whose primary interest was the investigation of the problems associated with the manufacture and use of tetraethyllead. An essential part of Dr. Kehoe's programme was the development of a large collection of the literature on lead and its compounds, a collection from which most of the abstracts in this bibliography have been prepared. The bibliography covers the years 1950 through 1964, and is presented as a health information service to the scientific community.

Reader Enquiry Service No. **72109**

Who Will Eat?

Michael Allaby. Tom Stacey. 1972. £2.90.

This book deals with the world food problem and discusses whether it can be solved or not. It deals with the effects of fertilizers and pesticides; the staggering wastages of food and the availability of water. The frightening effects of factory farming and the antibiotics in our livestock are described, together with the population explosion and the possible biological limitations on the human race. The author criticises current policies but also puts forward his own constructive alternatives.

Reader Enquiry Service No. **72110**

The Toxic Metals

Anthony Tucker. Pan/Ballantine. 1972. 50p.

The author's introduction states that "heavy metals are among the most dangerous and least understood of contaminants. Because they exist naturally as part of the earth's crust they occur in all soils, rivers and oceans. In the right quantities some are essential to life. Others are so poisonous that only a few millionths of a gram can kill. Many that are capable of disrupting living processes are in widespread industrial use, and, as contaminants, are extending through the biosphere, so that in increasing quantities they distort the naturally occurring distribution of metals to form an accidental but potentially disastrous addition to the diet of all living things."

The book is a study of the main known risks from the toxic metals, the author describing how each metal acts on the body, where it is escaping from, and what can be done about it. He pays special attention to the economics and politics of why some people do not care to stop heavy-metal pollution even when they know how.

Reader Enquiry Service No. **72111**

Air Pollution Aspects of Emission Sources: Petroleum Refineries. A Bibliography with Abstracts

U.S. Environmental Protection Agency. Publication No. AP-110, 1972.

Petroleum refineries contribute significantly to the overall air pollution level in the United States. To aid efforts to improve air quality, the Air Pollution Technical Information Centre (A.P.T.I.C.) has compiled this bibliography relevant to the problem and its solution. The abstracts cover 14 aspects of the problem and is intended to be representative of the available literature and not all-inclusive.

Reader Enquiry Service No. **72112**

Environmental Health Report 1971

Association of Public Health Inspectors. 25p.

In the Environmental Health Report for 1970 doubt was expressed about the Government's intentions with respect to environmental health administration in 1974 when local government will be reorganised. There appeared to be a danger of a unsatisfactory division of responsibility between county councils and district councils which would result in a splitting of the duties of public health inspectors. Since then the Government have accepted almost entirely the Association's views on environmental health administration and virtually the whole of this work is to be entrusted to district councils. The danger of dividing the profession has, therefore, been averted.

The Report deals with a number of subjects relating to environmental health, including food inspection, working conditions in offices and shops; clean air; housing; public cleansing and noise.

In the section on clean air stress is laid on the importance of local authorities starting smoke control programmes because 80 per cent of smoke pollution in Britain today is still caused by domestic smoke. Many authorities have made excellent progress and yet other local authorities think that because they were not designated black areas in 1954 by the Beaver Committee, smoke control has no relevance for them. The Report states that now is the time to look beyond so called black, grey or white areas and to look at the real need for smoke control. Amenity and the maintenance of satisfactory air quality are factors which must increasingly be taken into account when considering the advisability of smoke control. Local authorities in areas of low smoke pollution should consider that it is far easier to preserve something that exists than have to retrieve something which has been lost. The Association feels that the Secretary of State for the Environment could use more pressure towards authorities hesitant to start smoke control, using the powers granted under section 8 of the 1968 Clean Air Act.

With regard to industrial pollution the Report states that smoke emission from industrial plants now accounts for little more than 10 per cent of total smoke pollution in Britain, but there are many other pollutants which must be identified and controlled. There is a need for regular inspections of all industrial processes and plants in order to check the efficiency of pollution controls and to identify new sources of possible pollution. Monitoring programmes can then be adjusted accordingly and a thorough assessment made of the degree of health hazard involved. There also ought to be more effective liaison with the alkali and factory inspectorates, and there should be a statutory duty on these inspectorates to disclose relevant information about air pollution to the local authorities who have overall responsibility for the health and safety of their inhabitants.

The trend away from the use of solid fuel in industrial boilers has continued and has accelerated with the increasing impact of natural gas.

Regarding the new Regulations of Measurement of Grit and Dust from Furnaces the Association feels that January, 1978 is too long a time allowed for industry to modify existing plant, especially when one considers that the recommendations of the Working Party on Grit and Dust, upon which the regulations are based, were made in 1967. Another shortcoming in the control of grit and dust which the Report mentions is that the control of emissions does not extend to grit and dust from non-combustive processes and very significant amounts can be emitted from these sources. A degree of control exists under the Public Health Act, 1936, where a nuisance is caused to the inhabitants of the neighbourhood but it would be more logical and effective to control the rate of emission.

Information collected by the Association indicates that the number of complaints of noise nuisances received by local authorities is increasing at the rate of about 10 per cent each year. Traffic noise; aircraft noise; noise at work and neighbourhood noise are discussed and the Report says that the time is now long overdue when serious external noise nuisances should be regarded as rending a house just as unfit as dampness or insanitary conditions.

The Association rejects entirely the Confederation of British Industry's concept of a noise inspectorate employed by central government along the lines of H.M. Alkali and Clean Air Inspectorate. To be effective air pollution and noise control must be administered locally and in close liaison with the planning authority. Central and regional inspectorates are too remote to act expeditiously upon complaints from members of the public.

The Report concludes with a list of relevant legislation, and official reports and memorandum for 1971.
Reader Enquiry Service No. **72113**

Fine Dust and Particulates Removal
U. R. Jones. Noyes Data Corporation, New Jersey, U.S.A. 1972. $36.
The emission of particulate pollutants to the atmosphere can create numerous problems related to health, esthetics and/or economics. The severity of these problems is related to the total rate of emission, the physical and chemical characteristics of the emissions, and the environment surrounding the emission source. A source particulate pollutant may, therefore, be important because of the total amount emitted or because of the objectionable properties of the material emitted.

How to reduce such emissions and how to remove the particulates, preferably at the source, is described in this book, which is based mainly on U.S. Government Publication Board Reports (P.B. reports) and on U.S. patents issued mostly since 1960.
Reader Enquiry Service No. **72114**

National Coal Board Report and Accounts for 1971-72
H.M.S.O. respectively 57p and £1.15.
The feature which dominated the year 1971-72 in the British Coal Industry was the official strike called by the National Union of Mineworkers which lasted from 9 January to 27 February, 1972. The effect of the seven-week strike in the mines, together with the ten-week overtime ban which preceded it and the settlement on wages and conditions which followed it, was to transform a prospective operating profit of £35 million to an actual operating loss of £118 million.

Apart from the serious repercussions on the economy as a whole and on many other industries, the strike left the Board facing three major problems. The first was the massive deterioration in the financial position. An obvious way of increasing this would have been to put prices up. This would have meant an increase of at least 25 per cent. An increase of this magnitude would have had a major inflationary impact, have caused much hardship to those on reduced incomes, and have dealt a serious blow to the future market for coal. In the event the Board decided to limit the price increase to 7½ per cent as from 26 March, 1972.

The second problem was the deterioration in the sales situation. To remedy this the Board have launched into a major campaign of consumer reassurance, in which they have been given the full support of the unions within the industry. They have also received the positive assistance and co-operation of the distributive trade, the appliance manufacturers and installers and all their other partners.

The third and overriding problem was to restore industrial relations to a point at which there could be full and frank participation to achieve the best possible results for the industry and for all those who work within it. The Board have already indicated to the N.U.M. that they want to agree with them a framework within which future negotiations over pay and conditions can take place so as to reduce the risk of a further confrontation which would have a perilous effect on the industry.

The Board's collieries incurred an operating loss of £134.7 million in 1971-72. This was attributable to the direct and indirect effects of the national dispute and represented a deterioration of £140.2 million compared with the previous year.

Deep-mined output in 1971-72 was 109.2 million tons, 24.1 million tons less than in 1970-71. There was a loss of 25.5 million tons as a consequence of the strike and the preceding overtime ban; other stoppages and restrictions of work during the year increased the total loss to 26.3 million tons. Had it not been for these factors there would have been a small increase in output over the previous year. By the end of the strike about half of the coal-faces had been affected by deteriorating conditions. Altogether 25 faces at 17 collieries had to be abandoned. In addition, about 40 collieries suffered significant deterioration in the condition of access roadways, making recovery operations even more difficult.

Serious as this was, there were sound technical reasons for expecting even more widespread deterioration. With advances in mining techniques, physical conditions underground have become more sensitive to stoppages and even a limited standstill of faces can lead to a rapid build-up in stresses in surrounding strata causing severe damage to faces and equipment, particularly powered roof supports. The constant vigilance and vigorous action of management and officials throughout the strike period prevented more serious deterioration and also provided a good basis to begin recovery operations.

This recovery of production was much better than had been prudently forecast, reflecting the efforts made to safeguard collieries during the strike and the thorough preparation work which, together with the encouraging attendance following the resumption, enabled many faces to make an early start.

During the first week after the strike the collieries produced 1.97 million tons, 71 per cent of normal pre-strike output. Production increased to 2.51 million tons, almost 90 per cent of normal, by the fourth week.

The national average of 41.9 cwt. per manshift for the year was 4.9 per cent lower than in 1970-71, although face and overall productivity had shown a slight improvement over the previous year up to the time of the overtime ban. Following resumption of work after the strike, overall productivity showed early signs of recovery reaching 42 cwt. (94 per cent of the pre-overtime ban level) in the fourth week of normal operations. This trend continued into the present financial year and by June, 1972 overall productivity was almost 3 per cent ahead of the same period a year earlier. Of the 109.2 million tons of deep-mined output in 1971-72, 40.5 per cent was from collieries producing more than 50 cwt. a manshift.

Although coal production by opencast methods is only 8.7 per cent of total output, it is the most profitable of all the Board's activities and also makes a substantial contribution to clearing dereliction and to other countryside improvement schemes.

During the year production was built up in line with the Board's policy to maintain opencast output, subject to authorisation of sites, at around 10 million tons a year. An output of 9.9 million tons and a profit of £14.3 million were achieved. In addition, production of opencast coal by private operators under licence from the Board was 525,000 tons.

The Board sold 14.6 million tons of solid fuel in the domestic market, a decrease of 3.9 million tons compared with 1970-71. Sales of bituminous house coal decreased by 3.2 million tons to 10.6 million tons and sales of the Board's naturally smokeless and manufactured fuels decreased by 0.8 million tons to 3.9 million tons.

There was a considerable improvement in the availability of smokeless fuels both for open fires and closed appliances as compared with 1970-71. Except for the period of the strike, supplies were generally adequate to meet demands and Local Authorities were able to proceed with their plans for new smoke control orders.

The two improved versions of the "smoke-eating" room heater appliances designed to burn bituminous coal smokelessly are now being marketed. Another appliance has been developed in the family of "smoke-eaters", which burns bituminous coal singles smokelessly. A new open fire is being developed which will burn bituminous coal with a substantial reduction in smoke emission and, at the same time, maximise radiant output with an attractive view of the open fire.

Reader Enquiry Service No. **72115**

The Gas Council. Annual Report and Accounts 1971-72
H.M.S.O. £1.30.

Steady progress was made by the gas industry during 1971/72 towards the targets set for the mid-1970's. Sales of gas were 8,040 million therms—an increase of 30.4 per cent over the previous year.

The quantity of natural gas purchased was 8,057.2 million therms compared with 5,212.6 million therms in the previous year. Natural gas accounted for 87 per cent of total gas available. Considerable headway was made in the conversion programme. The appliances of 2.4 million customers were converted to natural gas—bringing the overall total to six million, nearly one-half of all customers.

Financial results

The industry earned a surplus of £15.1 million, compared with £2.0 million the previous year. This was after payment of interest charges of £124.8 million. The major factors influencing the financial results were an increase in gas sales of 30.4 per cent; a reduction in the overall cost of gas supplied per therm of 1.03p from 8.67p to 7.64p; a reduction in the average income per therm of gas sold of 0.87p from 8.70p to 7.83p.

Price restraint, initiated by the Confederation of British Industry in August, 1971, was agreed. The industry had already proposed an increase in gas tariffs—an average of 7½ per cent from 1 July, 1971—when the C.B.I. move was announced. Increases in gas tariffs were restricted to 5 per cent and deferred until January, 1972.

For the third successive year the average price per therm obtained from all gas sales fell. It was 0.87p less in 1971/72 than in the previous year. Average revenue from domestic gas sales rose by 0.5p per therm (4.7 per cent), reflecting the tariff increases averaging 7.5 per cent from January, 1971, offset by cheaper natural gas tariffs and lower commodity rates for customers using larger amounts of gas. The average revenue for domestic gas of 11.08p per therm is 0.10p per therm less than the average a decade ago. Industrial sales increased by 80 per cent and the average revenue fell by 1.25p per therm, reflecting the continued impact of natural gas on a wide range of industry.

Converting customers' appliances to burn natural gas cost Boards £87.3 million during the year. The cumulative costs of conversion to 31 March, 1972 were £248 million.

Natural Gas Operations

Total Gas Council expenditure on natural gas operations was £136.8 million of which £100.1 million represents the cost of natural gas bought. Investment on the natural gas transmission system during the year was £31.9 million—bringing the total to £274.7 million.

More than 153 miles of national natural gas transmission system was finished during the year, bringing the overall length to 2,106 miles. The transmission system as originally planned for gas from the southern North Sea is now nearing completion. The bulk of future construction work will involve reinforcement of the system, off-take stations, compressor stations and storage projects.

Compressor stations at Ambergate, Alrewas, King's Lynn and Peterborough were commissioned during the year. These "booster" stations are being built to ensure that the grid can be operated at maximum capacity.

Work on the third terminal at Theddlethorpe enabled the first phase—capable of receiving up to 600 m.c.f.d. from the Viking field—to be completed in the summer of 1972. The Hinckley Control Centre started operation on a continuous basis in November, 1971.

The Glenmavis liquefaction and storage plant was commissioned during the year. A second liquefaction and storage plant was being built at Partington, near Manchester. A plant at Hirwaun, South Wales, was the subject of a public planning enquiry.

Manufactured Gas

Maximum daily capacity of production plant at the end of the year was 5,418 m.c.f. or 26.8 m. therms. The number of works was reduced from 118 to 96. The total quantity of coal used for all purposes was 1.4 m. tons. Only two Area Boards were operating carbonising plant. Area Boards produced 0.50 m. tons of coke, compared with 1.49 m. tons the year before.

Gas Sales

Total gas sales in the year reached more than 8,000 million therms—a record 30 per cent increase over the previous year—and easily an all-time sales record for the industry. This expansion was forecast in the industry's 1968 marketing plan, and accords with the predictions made in the 1967 Fuel Policy White Paper. A total sales expansion of 71 per cent has been achieved since 1968/69.

Domestic sales increased by 392 million therms on the previous year. The increase was attributable to the continued high rate of installation of gas fires and of gas central heating systems. Commercial sales were 101 million therms higher than in the previous year. The expansion came mainly from the heavy school and hospital boiler changeover programme of 1970/71. Industrial sales showed a massive increase of 1,366 million therms in 1971/72. A particular feature of the year was the progress in interruptible sales which were 716 million therms up on the previous year.

Domestic Marketing

The number of cookers sold was 646,000, almost the same as the previous year. The fall of sales during the early period of conversion has now been arrested. Sales of independent space heaters totalled 830,000, 13 per cent up on the previous year. In addition, 129,000 "back boiler units" were sold, 61 per cent more than in 1970/71. Sales of hot water central heating appliances, including the back boiler units, totalled 335,000, 15 per cent up on 1970/71. The total gas central heating figures of 407,000 installations was 9.0 per cent up on the previous year. The two millionth gas central heating system was installed during 1971/72. Water heater appliances sales were 20 per cent up on 1970/71.

Domestic gas appliances sales rose sharply in the last two months of 1971/72, during and following the coal strike and electricity cuts. The increase, which applied particularly to gas fires and central heating systems, then continued beyond the end of that year. Gas, in competition with other fuels, gained a high proportion of the central heating being installed on home modernisation.

Industrial

Negotiations were completed for over 400 contracts for the supply of about 800 million therms a year. By the end of the year over 5,000 million therms a year of natural gas was contracted to be sold to industrial customers. These figures are in line with the rapid expansion planned to take industrial gas sales, as supply capacity increases, to a mid-1970's level about seven times that of 1968/69. About three-quarters of the 400 contracts were for firm (i.e. non-interruptible) supplies totalling about 300 million therms a year. Flexibility was an important aspect of all marketing policy decisions to develop accurate matching of supply and demand.

Reader Enquiry Service No. **72129**

Solid Smokeless Fuels Federation Annual Report April '71-March '72

Solid Smokeless Fuels Federation, York House, Empire Way, Wembley, Middlesex, HA9 0PA.

The Solid Smokeless Fuel Industry looked forward to the year April, 1971 to March, 1972 with considerable confidence. The period of uncertainty regarding availability was in the past, as new plant had been built during the previous year to meet the requirements of the immediate market and additional plant was in the course of erection to cater for future needs.

The Department of Trade and Industry and the Department of the Environment had been advised that as a result of the large investments by the National Coal Board and the Independent Producers in new solid fuel plant, the quantities of solid smokeless fuel available for the domestic market in 1972/73 would be 1½ million tons higher than the amount sold in 1970/71. This was before taking into account imports and was a higher tonnage than had ever been sold on the domestic market in past years. On this understanding the first task was to make this information known to Local Authorities and assure them that they could plan the extension of their smoke control programmes, new housing and House Improvement schemes based on a plentiful supply of solid smokeless fuel. This was backed up by the Department of the Environment who confirmed the position outlined by the Federation and urged that Local Authorities should energetically resume their clean air programmes.

A programme of promotion activities was prepared for both Local Authorities and the Public both by the Federation and by each of its members and the interest taken in new solid fuel appliances was gratifying. During the winter there had been a lull in the sales of appliances but these began to pick up very quickly; this pattern continued until well into the year 1971.

During the year a new breed of domestic solid fuel appliances was exempt under Section II(4) under the Clean Air Act for use in smoke control areas. These are the Coal Burning Roomheaters and Boilers advertised in the National Press and on television as the "smoke-eaters".

The Federation now represents all the solid fuel industries and includes the solid fuel distributive trades in addition to the producers.

The Report also deals with fuel production, exhibitions, external relations and services.

Reader Enquiry Service No. **72116**

The Electricity Council Annual Report and Accounts 1971-72

H.M.S.O. £1.85 net.

Central Electricity Generating Board Annual Report and Accounts 1971-72

H.M.S.O. 90p net.

Finance

The 1971/72 financial year was another disappointing one for the electricity supply industry in England and Wales. While total income rose by 13.2 per cent to almost £1,750 million, the return before interest on net assets employed was equivalent to only 5.1 per cent. After paying interest, the industry incurred a net loss of £23 million.

The year's results were in sharp contrast with those achieved as recently as 1968/69, when the industry made a profit of over £100 million after charging interest.

Total expenditure during the year under review amounted to £1,766 million. Of this, £1,617 million, an increase of nearly £150 million over the preceding year, arose on the revenue account. Almost one-third of the

extra expenditure was accounted for by fuel cost increases; the cost of other materials, goods and services also increased sharply. The sharpest percentage increase in individual cost elements was in local authority rates which rose by a further 17.7 per cent, as compared with 1970/71, following a rise of almost 9 per cent in that year.

Sales

At the end of March 1972, the industry had a total of 18,699,108 customers. Together they bought a total of 177,679 million units of electricity, an increase of 2 per cent over the previous year. This compared with a growth rate of 3.6 per cent in 1970/71.

Domestic sales throughout the whole of the year increased by 6.5 per cent, and average consumption per customer is now 4,222 units per annum.

Commercial sales also showed an increase during the year although the 3.9 per cent growth rate was somewhat lower than previous experience for this class of customer.

Electricity sales to industry were disappointing, these showed a 2.9 per cent decrease over the previous year, and while this was mainly due to the mineworkers' strike, the growth rate had been only 0.4 per cent in the period prior to this.

Generation

Power stations of the Central Electricity Generating Board supplied 190,525 million units of electricity in 1971/72, an increase of 2.35 per cent over the previous year. An encouraging feature of the year's operations was the improved performance of the 500 MW sets. Forty-two of these were in service by the end of the year, and they produced a combined output of over 63,000 million units—about 30 per cent of the total supply by all stations.

A record capacity of new generating plant—5,893 MW—was commissioned during the year, an increase of over 50 per cent compared with the previous year, and the simultaneous maximum demand met by the Generating Board of 39,925 MW was also a record, being 3.4 per cent higher than that met in 1970/71.

The Electricity Council shared the widespread concern at the effect of picketing at power stations and at incidents which took place during the mineworkers' strike, but it is gratifying to note that the arrangements for electricity rationing during the emergency were generally accepted as providing a reasonable measure of equity to all customers.

The mineworkers' strike also reinforced the view the industry has held over many years, that it should be less dependent on coal and free to buy its primary fuel from the cheapest source.

In March 1972, the Electricity Council adopted for the winter of 1977/78 a forecast of simultaneous maximum demand of 54,000 MW and a sales forecast of 252,700 million units. These forecasts represented annual average growth rates over the actual results of 1971/72 of 6.3 per cent for demand and 7 per cent for unit sales.

Transmission and Distribution

During 1971/72, the 400 kV, 275 kV and 132 kV transmission networks owned by the Central Electricity Generating Board were extended by 322 kilometres. The total length of the transmission system in commission at the end of March was 14,368 circuit kilometres, and at that date there were in commission 185 grid sub-stations with an aggregate transformer capacity of 122,920 MVA.

Research

The electricity supply industry spent a total of £16.2 million on research in 1971/72. Of this £4.7 million was charged to capital and £11.5 million to revenue account. Some £143,000 represented contracts placed at universities and colleges of technology.

Reader Enquiry Service No. **72117**

National Survey of Air Pollution 1961-71 Vol. I
H.M.S.O. £3.50, pp 192.

No other country in the world can boast, and we are entitled to boast, about a report recently published for Warren Spring Laboratory of D.T.I. The data has been analysed and interpreted by the Air Pollution Division of the Laboratory until 1972, under the direction of Dr. S. R. Craxford, M.A. (Oxon) D.Phil. Daily measurements have been taken from about 1,200 sites and submitted by public health inspectors working in over 350 towns of all sizes including some in rural areas. A remarkable collaborative project which records a success story of outstanding national and international significance.

Daily average smoke concentrations in U.K. decreased by about 60 per cent in the 10 years covered by the Survey and sulphur dioxide by about 30 per cent. The reduction in sulphur dioxide is especially welcome because it is contrary to expectations when the Clean Air Act, 1956 was passed and despite the absence of legislation directed specifically to its abatement or reduction. It may be that the increasing use of natural gas has some bearing on this.

The reasons for these downward trends are discussed in the present volume which is the first of four. It deals with the South East Region (excluding London), Greater London, and with the U.K. generally. The present position is summarised along with recent trends and changes in concentrations and the differing patterns of fuel usage. The suggestion is made that as the levels of smoke concentration achieved in London and the S.E. of England are the lowest in the country and have been obtained without any sacrifice in economic prosperity, they could provide a target standard for the remainder of the country. This is well said.

The report also states that emissions of smoke in the U.K. are estimated to have fallen by over 65 per cent between 1954 and 1970 in spite of a 9 per cent increase in population and a 29 per cent increase in the annual gross energy consumption. This decrease is expected to continue as more towns and cities follow the lead given by London, Salford, Sheffield and many smaller towns. Many towns, large and small, are still undeniably and unnecessarily polluted by innumerable domestic chimneys which release smoke and tarry matter at roof top level which is far below what would be tolerated for a chimney height on an appliance burning bituminous coal.

For a long time there has been a need to make reasonably equitable comparisons between one town and another. This the report does and at the same time enables comparisons to be made between one town and the region in which it is situated.

This is very helpful for those in local government and elsewhere who are striving to convince elected representatives and householders that smoke emanates mainly from house chimneys and consequently smoke control in any area is worthwhile and very rewarding.

According to Professor P. Lawther who is quoted, ill-effects have been detected in bronchitis patients when the 24 hour mean average concentrations of smoke and SO2 in the external air have exceeded about 250 $\mu g/m^3$ and 500 $\mu g/m^3$ respectively. It is stressed, however, that these figures should not be used as limits of safety.

Annual estimates of smoke emitted based on coal consumption show a reduction from 2.44 to 0.77 x 10^6 tonnes during the years 1950/1970. The North Region heads the list of annual coal consumption per head of population with 0.56 tonnes while the South East, excluding London, is at the foot of the league table with 0.14 tonnes. Although the average smoke concentrations

follow a similar trend for the two Regions with 88 $\mu g/m^3$ and 31 $\mu g/m^3$ respectively, this pattern is not followed throughout the Regions as the volatile content of the coal available in an area plays a vital part. A good example of this is Wales, having the second highest coal usage of 0.54 tonnes but the third from the lowest smoke concentrations at 33 $\mu g/m^3$. The report does not accept that the increased use of coal and the high smoke concentrations of the North compared to the South can be blamed entirely upon miners' concessionary coal. Coal has to be imported into the Northern Ireland increasing its cost considerably and yet domestic consumption is high.

From 1950-1962 total SO2 emissions steadily increased but since 1962 have remained fairly constant in spite of the additional energy consumed, although still approximately double those for smoke. The credit for this is given to the disappearance of gas coke, the increasing use of natural gas and the C.E.G.B. policy of dispersing SO2 through tall chimneys. Regional distribution of smoke differs considerably from SO2 in one respect, i.e. London has as high an average as the industrial North. This is believed to be due to the high population density and the high density of commercial premises but it is hoped that the restrictions imposed on the use of liquid fuels by the City of London (Various Powers) Act, 1971, will assist in reducing these figures.

The London Authorities are praised for a vigorous implementation of Smoke Control policies which have produced a decrease from 250 $\mu g/m^3$ in 1954 to 42 $\mu g/m^3$ in 1971. Their results are an example to the remainder of the Country of what can be achieved.

Measurements of grit and dust collected in deposit gauges show no reduction since 1962. These measurements were excluded from the National Survey as the figures are only valid for a small area around the gauge site and do not necessarily give a picture of pollution over an area. Failure to get a reduction over the last 10 years does, however, indicate the possible need to implement more vigorously the legal powers available to control grit and dust emissions.

Volume I is bound in an attractive cover but the facts contained have previously been made available to Authorities who are Members of the Standing Conference of Co-Operating Bodies. The information is undoubtedly useful for reference purposes and to have it all within one cover is an advantage and will save time in searching through files for various reports. It would be very helpful if investigations in the same depth could be carried out into some of the industrial pollution problems which trouble many authorities.

S. Cayton

Reader Enquiry Service No. **72118**

New additions to the National Society for Clean Air Library, available on loan

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SMOKE CONTROL AREAS

Progress Report

Position at 30th September 1972

(Figures supplied by the Department of the Environment)

	England			Wales			Scotland			Northern Ireland		
Smoke Control Orders Confirmed prior to 30.6.72	3,763			8			194			49		
Acres		1,088,778			1,097			104,649			11,587	
Premises			5,279,823			4,979			475,584			25,910
Smoke Control Orders Confirmed (30.6.72-30.9.72)	66			—			25			—		
Acres		44,252			—			11,234			—	
Premises			107,518			—			48,407			—
Totals	**3,829**	**1,133,030**	**5,387,341**	**8**	**1,097**	**4,979**	**219**	**115,883**	**523,991**	**49**	**11,587**	**25,910**
Smoke Control Orders Submitted	103			—			4			1		
Acres		41,944			—			2,751			610	
Premises			146,901			—			8,971			3,912
Grand Totals	**3,932**	**1,372,299**	**5,534,342**	**8**	**1,097**	**4,979**	**223**	**118,634**	**532,962**	**50**	**12,197**	**29,822**
Smokeless Zones (Local Acts) in operation	44			—			—			—		
Acres		3,400			—			—			—	
Premises			41,060			—			—			—

New Smoke Control Orders

The lists below are supplementary to the information in the last issue of **Clean Air (Autumn 1972)** *which gave the position up to* **30 June 1972.** *They now show changes and additions up to* **30 September 1972.**

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

The list of new areas in operation of smoke control is based on the plans submitted to the Department of Environment, but may erroneously include some local authorities who have made postponements, without notifying the Ministry of the fact.

ENGLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Northern

Whickham U.D. (No. 10). Tynemouth C.B. (No. 12). Boldon U.D. (No. 18). Gosforth U.D. (No. 1). Hartlepool C.B. (No. 20).

Yorkshire and Humberside

Baildon U.D. (No. 12). Darton U.D. (Nos. 15, 16, 17 and 18). Halifax C.B. (Nos. 17a, 17b, 18b). Dearne U.D. (No. 7). Hoyland U.D. (No. 1). Huddersfield C.B. (Gedholt-Birkby 1971). Pudsey B. (Nos. 10 and 11). Elland U.D. (South Ward 1970). Sheffield C.B. (No. 27). Brighouse B. (Norwood Green No. 20). Horsforth U.D. (Nos. 30 and 31). Leeds C.B. (Nos. 88, 89, 90 and 92). Spenborough B. (No. 12). Wakefield C.B. (Central Area No. 3).

North West

Preston C.B. (No. 4). Huyton-with-Roby U.D. (No. 8). Leicester C.B. (Nos. 28 and 29). Salford C.B. (Nos. 19, 21 and 23). Bebington B. (No. 14). Sale B. (No. 12). Blackburn C.B. (No. 11). Blackrod U.D. (No. 3). Farnworth B. (No. 5). Birkenhead C.B. (No. 8). Middleton B. (Langley (No. 10d). Oswaldtwistle U.D. (No. 3). Droylsden U.D. (No. 14). Leigh B. (No. 12). Stalybridge B. (Castle Hall No. 3). Barrowford U.D. (Nos. 4 and 5). Eccles B. (No. 13). Great Harwood U.D. (No. 3). Worsley U.D. (No. 9). Warrington C.B. (No. 16). Burnley C.B. (No. 12). Nelson B. (No. 6). Westhoughton U.D. (No. 6). Runcorn U.D. (No. 6). Prestwich B. (No. 11a). Brierfield U.D. (No. 5).

East Midlands

Sutton-in-Ashfield U.D. (No. 1). Ilkeston B. (Nos. 5 and 7). Kirkby-in-Ashfield U.D. (Nos. 5 and 6). Beeston and Stapleford U.D. (No. 12). Dronfield U.D. (No. 6).

West Midlands

Stoke-on-Trent C.B. (No. 25). Sutton Coldfield B.C. (Nos. 19, 20, 22 and 23). Stourbridge B. (Nos. 29 and 30). Aldridge-Brownhills U.D. (Nos. 30 and 31). Halesowen B. (No. 33). Coventry C.B. (No. 15). Wolverhampton C.B. (No. 15). Solihull C.B. (No. 17).

Greater London

Hillingdon L.B. (Nos. 7 and 14). Merton L.B. (Nos. 18 and 19). Brent L.B. (No. 7). Bromley L.B. (Nos. 13, 14 and 15). Harrow L.B. (No. 24). Hounslow L.B. (Heston and Isleworth Nos. 22, 23 and 24). Sutton L.B. (No. 24). Greenwich L.B. (Abbey Wood No. 4; Nathan Way 1970; Royal Arsenal Western Enclave; Riverside 1970; Plumstead No. 2, 1970; Page Estate 1970). Croydon L.B. (No. 13). Ealing L.B. (Nos. 52 and 53). Kensington and Chelsea R.L.B. (North and South Stanley 1970). Richmond-upon-Thames L.B. (Twickenham No. 10). Wandsworth L.B. (No. 4).

Outside the Black Areas

Ramsbottom U.D. (No. 4). Burton-upon-Trent C.B. (No. 2). Glossop B. (No. 5). High Wycombe B. (No. 7). Lincoln C.B. (No. 4). Whiston R.D. (Halewood No. 1). Warrington R.D. (No. 5). Whitley Bay B. (Nos. 7 and 8). Wortley R.D. (Chapeltown Burncross; Hunshelf and Grenoside). Peterborough C.B. (No. 2). Dartford B. (No. 11). Reading C.B. (Nos. 15 and 16). Rugby B. (No. 14). Southampton C.B. (No. 11). Easington R.D. (Peterlee No. 1). Rawtenstall B. (No. 3). Runcorn R.D. (Nos. 4 and 5). Skipton U.D. (No. 7). Leamington Spa B. (No. 10). Market Drayton R.D. (No. 1). Chesterfield R.D. (No. 11). Blackwell R.D. (No. 1). Darlington R.D. (Newton Aycliffe No. 5). Buxton B.C. (Fairfield No. 1).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Northern

Newburn U.D. (No. 14). South Shields C.B. (Nos. 9 and 10). Tynemouth C.B. (No. 13). Newcastle-upon-Tyne C.B. (No. 15).

Yorkshire and Humberside

Bradford C.B. (North and East). Halifax C.B. (Nos. 17c and 18a). Leeds C.B. (Nos. 104, 105 and 106). Royston U.D. (No. 1). Wath-upon-Dearne U.D. (No. 5). Hoyland Nether U.D. (No. 2). Spenborough B.C. (No. 13). Stanley U.D. (Yorks.) (No. 6).

North Western

Atherton U.D. (No. 7). Barrowford U.D. (No. 5). Bebington B. (No. 26(i)). Darwen B.C. (No. 11). Dudley C.B. (No. 58). Horwich U.D. (No. 5). Leigh B.C. (No. 13). Altrincham B.C. (No. 11). Blackrod U.D. (No. 4). Manchester C.B. (Alexandra Road). Tottington U.D. (No. 4). Walsall C.B. (No. 14). Warrington C.B. (No. 17). Widnes B.C. (No. 10). Ashton-under-Lyne (No. 14). Bredbury and Romiley U.D. (No. 4). Eccles B.C. (No. 16). Fulwood U.D. (No. 3). Golborne U.D. (No. 3). St. Helens C.B. (No. 8).

East Midlands

Chesterfield B.C. (No. 6). Mansfield Woodhouse U.D. (Nos. 3 and 7a). Alfreton U.D. (No. 8). Dronfield U.D. (No. 7).

West Midlands

Walsall C.B. (No. 14). Wolverhampton C.B. (No. 16).

Greater London

Harrow L.B. (No. 26). Havering L.B. (No. 6).

Outside the Black Areas

Buxton B.C. (Fairfield No. 1). Grantham B.C. (No. 20). Waltham Holy Cross U.D. (Nos. 5 and 6). Aylesbury B.C. (No. 2). Bentley-with-Arksey U.D. (Nos. 1, 2 and 3). Chesterfield R.D. (No. 14). Preston R.D. (Lea). Southwell R.D. (No. 1). Swadlincote U.D. (No. 4). Dartford B.C. (No. 12). Easthampstead R.D. (Bracknell Nos. 2 and 3). Rawtenstall B.C. (No. 6). Todmorden B.C. (No. 10). Warrington R.D. (Nos. 7 and 8). Watford B.C. No. 9).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Northern

Gateshead C.B. (No. 14). Newburn U.D. (No. 15). Hebburn U.D. (No. 14). Darlington C.B. (Nos. 8 and 9). Teesside C.B. (Nos. 9b, ‘c’, ‘d’, 10, ‘e’ and ‘f’). Jarrow B.C. (Nos. 7 and 8). Gosforth U.D. (No. 3). Boldon U.D. (No. 20). Whickham U.D. (No. 11). Hartlepool C.B. (No. 23).

Yorkshire and Humberside

Conisbrough U.D. (Nos. 2, 3 and 4). Stanley U.D. (No. 3). Barnsley C.B. (No. 15). Brighouse B.C. (No. 17). Pudsey B.C. (No. 12). Heckmondwike U.D. (No. 9). Leeds C.B. (Nos. 107, 108, 109 and 110). Huddersfield C.B. (Fartown-Fixby). Kingston-upon-Hull C.B. (No. 12). Elland U.D. (West Ward). Wath-upon-Dearne U.D. (No. 6).

North Western

Birkenhead C.B. (Nos. 9 (Thingwall) 15, 18 and 19). Heywood B.C. (No. 11). Droylsden U.D. (No. 16). Rochdale C.B. (Mayfield and Halifax Road). Tyldesley U.D. (No. 4). Farnworth B.C. (No. 6). Blackburn C.B. (Nos. 12 and 13). Audenshaw U.D. (No. 7). Manchester C.B. (Mount Road). Runcorn U.D. (No. 9). Crompton U.D. (No. 6). Bolton C.B. (Bradford Ward and West Ward). Westhoughton U.D. (No. 8). Middleton B.C. (Nos. 18 and 19). Wallasey C.B. (No. 17). Ashton-under-Lyme B.C. (No. 15). Darwen B.C. (No. 12). Stalybridge B.C. (Brushes Estate and Huddersfield Road/Copley Estate). Irlam U.D. (No. 6).

East Midlands

Alfreton U.D. (No. 7). Chesterfield B.C. (No. 7).

West Midlands

Birmingham C.B. (No. 160). Stoke-on-Trent C.B. (No. 26). Halesowen B.C. (No. 36). Stourbridge B.C. (No. 31). Sutton Coldfield B.C. (Nos. 24 and 25). Warley C.B. (No. 10). Coventry C.B. (No. 16). Wolverhampton C.B. (No. 17). West Bromwich C.B. (Nos. 22 and 23).

Greater London

Merton L.B. (Nos. 24 and 25). Harrow L.B. (No. 27). Barnet L.B. (No. 14). Lambeth L.B. (No. 28). Waltham Forest L.B. (No. 17).

South Western

Bristol C.B. (Nos. 9 and 11).

Outside the Black Areas

Reading C.B. (No. 18). Cambridge B.C. (No. 3). Crewe B.C. (No. 5). Worksop B.C. (Nos. 1 and 2). Consett U.D. (No. 1). Letchworth U.D. (Part of Wilbury Area). Skipton R.D. (Sutton No. 2). Thurrock U.D. (No. 9). Glossop B.C. (No. 6).: Whitley Bay B.C. (No. 9). Hazel Grove and Bramhall U.D. (No. 8). Burton-upon-Trent C.B. (No. 3). Grantham C.B. (No. 21). Southampton C.B. (No. 13). Rugby B.C. (No. 15). Belper R.D. (No. 4). Meriden R.D. (No. 7). Hale U.D. (No. 4). Lincoln C.B. (No. 5). Hemsworth R.D. (South Kirkby No. 1).

SCOTLAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Edinburgh (Pilton No. 2; Murrayfield/Cramond No. 3 (Part 2), Colinton No. 1). Glasgow (Maryhill). Hamilton (Laignstonehill—Remainder). Lanark County (Bankhead No. 1).

NEW SMOKE CONTROL ORDERS CONFIRMED BUT NOT YET IN OPERATION

Airdrie (No. 1). Ayr County (Pennyburn). Bearsden (No. 4). Clydebank (Whitecrook No. 9). Dundee (Fintry and Douglas). Dumfries (Nunwood/Hardthorn). East Kilbride (South East Extension and South West Extension). Edinburgh (Craigmillar No. 1 (Part 1)). Falkirk (No. 10). Galashiels (Tweed Road and Buckholm). Glasgow (Kelvinside and Ruchill). Hawick (Lynnwood). Kirkcaldy/Bridgeton Milngavie (No. 2). Paisley (West End; Dykebar No. 11; Candren No. 12; Barshaw No. 13). Port Glasgow (No. 7). Renfrew Burgh (No. 7). Stirling County (Bonnybridge No. 2).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Edinburgh (Colinton No. 2). Barrhead (No. 4 Fereneze). Port Glasgow (No. 8). Dunbarton (Hardgate/Duntocher).

NORTHERN IRELAND
NEW SMOKE CONTROL ORDERS IN OPERATION

Castlereagh R.D. (No. 5). Craigavon D.C. (No. 2). Craigavon D.C. (Variation) (No. 1).

NEW SMOKE CONTROL ORDERS SUBMITTED BUT NOT YET CONFIRMED

Antrim R.D. (No. 2).

The table of Smoke Control Positions in Regions of England, as at 30th June 1972 printed in the Autumn edition of "Clean Air" has been revised by the Department of the Environment and now reads as follows:-

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30th June 1972

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	47,103	37·6	193,874	35·1
Yorks & Humberside ..	226,418	60·1	744,498	63·7
East Midlands	79,087	29·5	236,472	46·2
Greater London	271,522	83·0	2,312,780	87·6
North West	221,661	55·3	925,773	54·4
West Midlands	97,133	39·0	437,518	41·6
South West	7,505	28·5	28,695	19·3
Total (black areas) ..	950,429	53·5	4,879,610	62·7
Outside black areas ..	191,777		532,201	
Grand Totals	**1,142,206**		**5,411,811**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke control orders (eg: there may be some areas of open country).

SMOKE CONTROL POSITION IN REGIONS OF ENGLAND

at 30th September 1972

(Figures supplied by the Department of the Environment)

(1) *Region*	(2) *No. of black area acres covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(3) *Percentage* of total black area acreage in region covered*	(4) *No. of black area premises covered by smoke control and smokeless zones orders confirmed or awaiting decision*	(5) *Percentage* of total black area premises in the region*
Northern	52,288	41·7	212,759	38·5
Yorks & Humberside ..	230,946	61·3	758,371	64·9
East Midlands	80,233	29·9	237,901	46·5
Greater London	273,217	83·5	2,328,914	88·2
North West	225,307	56·2	952,496	55·9
West Midlands	98,286	39·5	446,380	42·4
South West	11,231	42·6	41,278	27·7
Total (black areas) ..	971,508	54·7	4,978,099	64·0
Outside black areas ..	400,791		556,243	
Grand Totals	**1,372,299**		**5,534,342**	

* The percentage shown in columns (3) and (5) above are percentages of the *total* acreage and of the *total* number of premises in the black areas concerned. In practice it may not always be necessary for the whole of the black area authority's district to be covered by smoke control orders (eg: there may be some areas of open country).

Letters to the Editor

The Editor,
Clean Air
Sir,

Mr. E. R. Watkins wrote at considerable length in your autumn issue regarding the future control of atmospheric pollution and expressing the view that this work ought to have been allocated to the new county councils. I do not propose to write at the same length but will try to be brief and to the point.

In the Government's original White Paper responsibility for air pollution control was allocated to county councils but Mr. Peter Walker very wisely accepted the validity of those who argued that this should properly be a district council function. Indeed, there are no valid grounds for placing the control of air pollution in the hands of the county councils. This is not work which requires wide areas of administration to be carried out effectively. The effects of industrial air pollution are felt locally and people affected by it look to the local authority and its inspectors on the spot for rapid action. Public health inspectors have acquired very considerable expertise in dealing with the many thousands of non-scheduled processes and maintain a close liaison with the alkali inspectorate on problems involving scheduled processes. In addition, district councils have a vast amount of experience of domestic air pollution. This work is closely linked with their housing duties, and as housing is also a district council function, it would be illogical if the control of domestic air pollution were not the responsibiity of the district council also.

Mr. Watkins is advocating what the Association has strenuously fought against, namely, the chopping up of environmental health into its component parts and wrapping each up in a self-contained package. The Association believes that the environmental health of the country can best be promoted by regarding it as one single concept with interlocking parts, and it is this principle which the Government have very wisely accepted in the allocation of functions in the forthcoming local government reorganisation. Even Mr. Watkins infers that the training of public health inspectors is developing along the right lines and commends the under-graduate courses at Aston and Salford. The Association is very conscious of the need to keep training under constant review and to see that it matches the ever-widening breadth and increasing complexity of the inspector's duties. It would be the height of folly, however, having developed training in this way, to so fragment the inspector's duties as to destroy the profession.

Yours faithfully,

R. JOHNSON.

The Association of Public Health Inspectors,
Grosvenor Place,
London.

The Editor,
Clean Air
Sir,

The letter from E. R. Watkins published in your Autumn edition of "Clean Air" seems to me to display an ignorance of the subject which should have precluded publication and one's mind boggles as to why, in fact, it was.

Of course District Councils must carry out Air Pollution Control functions, it would be quite idiotic to attempt it any other way, they will be the ideal size to operate effective control. Mr. Watkins appears to be under the impression that the Alkali Inspector is at present the only person contributing to any form of control. Perhaps someone in Devon will explain the facts of life to him and add that Local Authorities, of which he is so contemptuous, have brought about the great success in smoke control of which this Country, quite rightly, now boasts. The reason he does not hear about it is because it is carried out so well and without the ballyhoo some other people employ.

I can assure Mr. Watkins that new Air Pollution Control methods are not a mystery to Public Health Inspectors specialising in Air Pollution Control and adequate channels of communications already exist, i.e. Association of Public Health Inspectors, Warren Springs Laboratory, National Society for Clean Air and Royal Society of Health, etc.

I fail to understand Mr. Watkins' point on S 94(5) of the Public Health Act, 1936. The section does not say "best equipment" it says "best practicable means" which of course embraces correct operation and maintenance, and what about the Clean Air Acts?

The Government's original ideas were not correct Mr. Watkins, that is why they were changed, not because Local Government Associations wanted it, but because commonsense allied with past experience demanded it.

Yours faithfully,

T. GREGSON.

Kentmere Drive,
Cherry Tree,
Blackburn,
Lancashire.

Mr. Watkins' letter was published for the same reason that Mr. Gregson's letter is. Ed.

AIR POLLUTION ABSTRACTS

Papers presented to the 39th Annual Conference of the National Society for Clean Air, Scarborough, 16-20 October, 1972.

1274 Pollution Control—How Far Can We Go? Stairmand, Dr. C. J. The author states that we still have a long way to go before we can relate emission control to the total cost to the community but thinks it possible to draw up a balance sheet in terms of an actual process and its immediate ramifications on the works concerned. Industry will have done its share if it contains its emissions to the standards set out by the Alkali Inspectorate, modified as these are from time to time as technology advances. We should insist, however, that the load is spread evenly, and there should be definite limits to the time a plant is allowed to operate in a sub-standard manner, and then only if the purpose of the continued operation is to obtain data for eventual rectification of the trouble. In the last resort there is no substitute for fundamental and basic study of all the many aspects of pollution control and dispersion, however impatient we may be for a quick result.

1275 Metals in the Atmosphere. Fish, R. A. The author's survey shows that hazards do arise from metals in the atmosphere. In most cases the hazard is low and is only likely to be of concern in specific local circumstances. However, certain metals, notably lead, cadium and nickel do give cause for more general concern. The author feels that substantial sums of money are unlikely to be spent or strong governmental action taken because of vague claims or fears of dangers. Therefore it is almost essential to demonstrate some significant harmful action on man or his environment. Some research work is being carried out in the U.K. There is a national network of seven environmental analysis sampling stations now established in the U.K. and are intended to make possible an intensive study of heavy metals in the atmosphere which can be set in parallel with agriculture and public health surveys.

1276 The Scheduled Processes. Ireland, F. E. This paper deals in detail with the determination and implementation of "best practicable means" and case study briefs of various processes, the author states that the Inspectorate is well aware of deficiencies, blemishes and unresolved problems. They never cease to strive for improvement, even when there are no complaints from the public. But an informed public opinion is a great help in assessing the extent of effects on the environment and in putting pressure on reluctant owners.

1277 Air Pollution and the Chemical Industry. Whiteley, F. Traces some of the historical backgrounds to chemical processes and shows how problems arising are being tackled today. The author states that pollution is a problem that is being actively tackled in the chemical industry not with words but with deeds. Technology may be responsible for bringing about some of the fears but technology is also providing the solutions.

1278 Odour Nuisances in Industry. Jones, T. R. Odours which are emitted by chemical plants are more likely to produce public complaint than almost any other pollution to which they may give rise. The author describes sources of odours and the principles of odour control and then considers in detail the main types of control methods available.

1279 Odour Nuisances in Agriculture. Peakin, F. H. Odour nuisance from agriculture is a genuine problem; not only are the frequency and intensity of smells increasing but public toleration of them is decreasing. The problems result mainly from the disposal of animal wastes. The author describes agricultural odours as statutory nuisances in English Law and discusses their origin and nature. Various remedies are then considered in detail.

1280 Effects of Air Pollution on Plants. Jones, L. H. P. and Cowling, D. W. The paper is concerned with plants as receptors of air pollutants and is divided into two main sections; in the first the authors deal with general principles and in the second with specific air pollutants. Amongst these the authors have selected the more important in terms of their known effects, and have included some discussion of the effects of photochemical smog. Air pollution has long been recognised as a cause of injury or damage to plants, sometimes resulting in large economic losses.

National Society for Clean Air

134-137 North Street, Brighton BN1 IRG (Brighton 26313)

The parent of the Society was the Coal Smoke Abatement Society, established in London in 1899. It did valuable pioneering work and accomplished the first necessary stage of making it understood that clean air was not the pet notion of a few cranks. It co-operated with a provincial association that had been formed in 1909—the Smoke Abatement League of Great Britain. These two bodies amalgamated in 1929 to form the National Smoke Abatement Society. This name was retained until 1958, when it was changed to the present one.

From a handful of individuals the Society's membership has grown to include not only considerable private membership both at home and abroad, but membership of local authorities, corporate bodies, (representing the Learned Societies and Institutions), the fuel industries and those industries concerned with the production of appliances and equipment connected with clean air.

The Society is a voluntary body and receives no official grant and therefore essentially subsists on the subscriptions of its members. The general policy of the Society is Directed by the Executive Council and its Committees. There are twelve Divisional Councils of members, with their own committees and honorary officers.

The Society's objects are, in brief, to promote and create by publicity and education an informed public opinion on the value and importance of clean air and to initiate, promote and encourage the investigation and research into all forms of atmospheric pollution in order to achieve its reduction or prevention.

Membership of the Society and Subscriptions

Membership of the Society is open to any individual, corporate body or local authority. Subscription rates are given below.

Individual Members
Not less than £3. Subscriptions can be paid by Covenant, minimum of seven years at £1.83, the balance being recoverable from the Inland Revenue by the Society. Those Members wishing to pay their subscription by Bankers order or wish to Covenant with the Society are requested to apply for the necessary forms for completion.

Local Authority Members

Population	£	
Less than 25 000	10	appointing 2 representatives
25 001 to 50 000	13	appointing 2 representatives
50 001 to 75 000	17	appointing 2 representatives
75 001 to 100 000	23	appointing 3 representatives
100 001 to 175 000	35	appointing 3 representatives
175 001 to 250 000	40	appointing 4 representatives
250 001 to 375 000	45	appointing 4 representatives
375 001 to 500 000	50	appointing 5 representatives

Over 500 000, £15 and 1 additional representative for each additional 1 000 000 of population or part thereof.

Corporate Members
Not less than £40 (appointing 4 representatives and 2 delegates in each appropriate division) or not less than £23 (appointing 2 representatives and 1 delegate in each appropriate division)

Associate Members
Not less than £3

Note: The Society's subscription year commences 1st April.

National Society For Clean Air

NEWS FROM THE DIVISIONS

EAST MIDLANDS

The East Midlands Annual General Meeting was held in the Rural Council Offices, Brigg, Lincolnshire, on 6 July, 1972. A welcome to the members present was extended by Councillor V. Farmery, Chairman of the Glanford District Council. The Minutes of the Annual General Meeting held at Chesterfield on 8 July, 1971 were read and confirmed by the meeting. This was followed by the Honorary Secretary's report for the year 1971/72.

It was resolved that the officers for the year by appointed as follows:

Chairman: Mr. H. B. Dunstan.
Deputy Chairman: Alderman A. Lister Robinson.
Honorary Secretary: Mr. E. F. Raven.
Honorary Auditor: Mr. H. N. Eardley.
Scrutineers: Mr. V. Wales and Mr. W. R. Brownhill.

The incoming Chairman Mr. H. B. Dunstan said that he would do his best to foster the aims of the Society and to serve the Branch. Mr. Dunstan also paid tribute to the retiring Chairman, Councillor C. E. Holland, for his service during the year and for the firm and friendly way in which he had Chaired the Branch.

Reference was made to the possible effect which Local Government Reorganisation might have on the future of the Society and in particular it was considered that the opportunity might be taken to reconsider the boundaries of some of the Divisions. It was agreed that Councillor Mrs. Ashley would raise this matter at National level.

A suggestion was made that there should be a co-opted member from the oil industry and it was agreed that if a nomination was forthcoming then this would be favourably considered.

The Chairman expressed the thanks of the meeting to Councillor Farmery and to the Glanford Brigg Rural District Council for their hospitality and also thanked Councillor Binns and Mr. Foster for the excellent arrangements which had been made for the meeting.

In the afternoon the members visited the Lindsey Oil Refinery at Killingholme. A colour film describing the construction of the refinery was shown by Mr. J. B. Johnston, the Training Officer, who afterwards answered numerous questions with the assistance of Mr. I. Johnson, the Senior Process Engineer.

The Refinery is owned by the Total and Fina Groups and refines 21 different crudes from the Middle East and the Near East countries as well as from the North Sea. The products include petrol for car engines, fuel oils for heavy and light industry and also for central heating, etc., kerosenes for aircraft and farm vehicles, bitumen for road use as well as butane and propane gas for such applications as camping equipment and cigarette lighters. The refinery was officially opened on 26 July, 1968 but actually came on stream on 1 May, 1968. The Company did not adopt the normal procedure which is for the contractors building the refinery to have a specialist start up crew to run the refinery for a period and then hand over to the company. In this instance the Lindsey refinery had their own personnel pre-trained for six-nine months who were brought in early and got to know the plant as it was being built. Many of those people are still working at the refinery.

Precautions are taken to minimise the pollution of the estuary and also of the atmosphere. Water which is contaminated with oil is agitated to ensure that the oil frees itself and floats and this then passes through a series of skimming processes in each of which the oil is taken from the top of the water. The effluent from the final gate consists virtually of clear water. The oil taken from the top is known as slops and this is reclaimed and turned back into the system to be re-processed. The biological oxygen demand at the fall out is understood to be less than that for effluents from other industries further up the river.

Waste gases are burnt at the flarestack which also acts as the safety valve for the refinery.

Sulphur dioxide measurements are taken within a 12 mile radius of the refinery using the lead candle for the purpose. Wind direction and speed are also charted on a 24 hour drum which is changed every morning and it is therefore possible to produce a wind direction and speed for any specified time and date. The refinery comes under the responsibility of the Alkali Inspectorate who also maintain independent apparatus for the measurement of sulphur dioxide between the Lindsey Oil Refinery and another adjacent refinery on the river bank.

At the end of the visit the members were given refreshments by kind invitation of the Company.

Meeting on 7 September and Visit to Steetley Dolofrit Works

A meeting of the East Midlands Division was held at the Van Dyk Hotel, Clowne, on 7 September, 1972. Members were given a Civic Welcome to the Clowne Rural District by the Chairman of the Council, Councillor E. L. Wood.

It had been arranged that a speaker from a Steetley Manufacturing Company would come to talk about the firm's products and their problems in dealing with air pollution but owing to urgent matters at the works the speaker had been unable to attend.

To fill this gap in the proceedings the Secretary showed a film strip on Air Pollution by Professor R. S. Scorer. This was followed by a short discussion.

The Chairman, Mr. H. B. Dunstan, said that in closing the morning session he would like to thank the Chairman and members of Clowne R.D.C. for acting as hosts to the Division on this occasion and especially for entertaining some of the members to lunch. Thanks were due in particular to Mr. T. Robinson, the Council's Surveyor, who had been responsible for all the arrangements.

Members were then entertained to an excellent lunch by kind invitation of the Steetley Manufacturing Company and the Clowne R.D.C.

In the afternoon members met at the Whitwell Works of the Steetley Manufacturing Company Ltd., which is the largest and most diverse of the group's five factories dealing with solomite, which is the double carbonate of magnesium and calcium. It has many uses ranging from refractories to the pharmaceutical industry. It was first recognised as a distinct mineral by DOLOMIEU in 1799 and the range of mountains in the South Tyrol known as the Dolomites are named after him.

Using both pictorial and diagrammatic illustrations of the works, Mr. G. Plant, a Director of the Company, described the various processes from excavation, through the successive crushing plants and kilns, to the final products, samples of which were shown to the members.

The products of the factory are:

Dolodust: Pulverised dolomite of specified fineness for neutralising the effects of explosions in coal mines.

Maglime: Finely graded agricultural limestone for neutralising acidity and correcting magnesium deficiency in the soil.

Dolofrit: A high temperature fired fettling grade dolomite with iron addition. Available in two gradings for maintenance of open hearth and electric arc steel furnaces.

Doloron: A hard fired, low iron, dolomite used for the production of blocks for lining basic oxygen steel making furnaces.

Roadstone and Dolofil: Roadstone is used for forming the sub-base for roads and for roadwork repairs. "Dolofil" is a fine dolomite powder used in the production of asphalt for road surfacing and repairs.

Concrete Aggregates and Ready Mixed Concrete: Concrete aggregates and ready mixed concrete are extensively used in the building and civil engineering industry. These products are marketed by the Steetley subsidiary company Alan S. Denniff Ltd.

Doloflux: Used as a fluxing agent for blast furnace iron ores. The magnesium carbonate content converts to magnesia in the furnace, reducing the viscosity of the slag and improving workability.

Pollution problems were outlined by Mr. Plant who answered numerous questions. The use of pulverised coal is necessary to obtain the high temperature (1,600°C) at which the rotary kiln has to operate. Dust arrestment is by electrofilters.

The talk by Mr. Plant was intended as a preliminary to a tour of the works themselves but the onset of heavy rain frustrated what would have been a most interesting sight of the processes which Mr. Plant had described.

Before leaving the works light refreshments were kindly served by the Company.

Ald. Robinson voiced a warm vote of thanks to the Steetley Manufacturing Company Ltd. and especially to Mr. Plant for affording members the opportunity to visit the works and for the hospitality which the Company had kindly provided.

E. F. Raven
Hon. Secretary

"Air Knows No Frontiers"

INTERNATIONAL NEWS

UNITED NATIONS

Plans taking shape for two major Meteorological Research Experiments

Plans for two major meteorological research projects have been developed at two conferences held at the headquarters of the World Meteorological Organization (WMO), Geneva, from 5 to 12 September 1972. These experiments fall within the Global Atmospheric Research Programme (GARP), which has been undertaken on a joint basis by WMO and the International Council of Scientific Unions (ICSU), a non-governmental body.

The first experiment, known officially as the GARP Atlantic Tropical Experiment (GATE), which is scheduled for 1974, will involve the use of all modern meteorological observing techniques, including satellites, aircraft and ocean vessels. It will enable detailed scientific measurements to be made over about one third of the world's tropical belt extending from the most western part of the Indian Ocean across Africa, the Atlantic Ocean, South and Central America to the most eastern part of the Pacific Ocean. Ships will be stationed over a large area of the Atlantic Ocean.

Particularly intensive measurements will be taken by radar-equipped oceanographic ships in a concentrated area of about 500,000 square kilometres centred at 25 degrees west and 10 degrees north in the eastern Atlantic. The present indications are that satellite observations will be obtained from American and Soviet satellites and that, in particular, a stationary satellite will be placed over the experiment area observing it 24 hours a day. About 12 to 15 specially equipped aircraft and about 25 scientific ocean research vessels will take part in the experiment, thus constituting what will probably be the biggest international fleet of ocean-going vessels ever assembled for peaceful purposes.

While many of the highly developed countries of the world will be making substantial contributions to the experiment, its success will depend no less upon the active participation of the developing countries in the tropical regions of Africa and South America. Senegal will have a particularly important role to play since Dakar will be the operational centre for the ships and aircraft taking part in the experiment. The World Weather Watch programme of WMO will constitute an essential basis to the experiment to which special observational programmes will be added.

An International Scientific Management Group (ISMG), headed by two distinguished scientists, Dr. J. Kuettner of the United States and Dr. Tarbeev of the Soviet Union, will supervise the detailed arrangements for the planning and implementation of the experiment, both having been appointed by the Secretary-General of WMO for this purpose. They will be assisted by a group of eminent scientists whose services are being provided on a voluntary basis by the countries concerned. The ISMG will conduct most of its activities at the headquarters of the United Kingdom Meteorological Office, where advanced computer facilities are available and at the WMO secretariat in Geneva.

The main scientific aims of GATE will be to explore the primary energy source for the atmospheric circulations around the globe. This energy source lies in the tropical oceans which store the heat received from the sun. The mechanism by which this energy is transferred to the atmosphere is obscure, involving disturbances ranging from 10 to 10,000 kms. in size. These will be extensively observed by GATE, but once this mechanism is understood it is expected that advanced computer models will predict the daily weather not only in the tropics but at all latitudes for periods exceeding two weeks.

The First GARP Global Experiment (FGGE)

This experiment, which is scheduled for 1977, will provide a global meteorological data set more complete than at any previous time in the history of meteorology.

The purpose of the conference was to develop an over-all plan for this experiment on the basis of proposals formulated by the Joint GARP Organizing Committee.

The scientific aims of FGGE are to improve our knowledge and understanding of the global circulation of the atmosphere, the physical basis of weather and climate, the development of more realistical mathematical models for extended range forecasting and climate.

The experiment which will be of limited duration and based on recent technical and scientific advancements will co-ordinate further work in these fields in all parts of the world in such a way that they culminate in the same period and thus complement each other to the fullest possible extent.

NEW ZEALAND

New Zealand Parliament are currently considering a Clean Air Act. The Act includes provision for control of Domestic Fires, which were exempted under the Smoke Restriction Regulations of 1964. The Act is largely modelled on the U.K., Clean Air Acts and the Queensland Clean Air Bill. There is, however, no provision for subsidies for conversion of domestic prem-

ises, but there is provision for local bodies to make loans under certain circumstances to enable necessary changes to be made. This Act is not expected to come into force until 1975. Provision has been made for Local Authorities to declare Clean Air Zones, and also for Government to compel Local Authorities who are reluctant to do so.

SOUTH AFRICA

Cape Town is fighting a battle against ever-increasing smoke pollution—but a City Council spokesman and pollution experts have said that everything possible will be done to ensure victory.

The number of times that smoke has reduced visibility in the Peninsula to 10 nautical miles or less in one year has risen from 22 in 1962 to 98 in 1971.

A spokesman for the meteorological office at D. F. Malan Airport said that over the past 15 years the amount of smoke in the air has steadily increased.

The meteorological office has recorded the number of times that smoke has reduced visibility to 10 nautical miles or less each year.

1962—22	1966—38	1969—93
1963—21	1967—37	1970—117
1964—41	1968—55	1971—98
1965—58		

In the war against air pollution all plans for proposed new industry in Cape Town had to be carefully scrutinized by the City Council's Health Department the Medical Officer of Health Dr. R. M. Langerman.

Dr. Langerman has said that it has not yet been necessary to take any action against small, private industries as the attitude has been one of co-operation and willingness to comply with the city's pollution controls.

His department has also begun visiting established industry to advise on and encourage smoke conrol. Response has been encouraging.

Undertakings have been obtained to heighten smoke stacks, maintain them properly and "lag" them to prevent the condensation of sulphur trioxide.

The Control of Gaseous Sulphur Compound Emission

The North Western Branch of the Institution of Chemical Engineers, in conjunction with the Department of Chemical Engineering at the University of Salford, will be holding a conference on "The Control of Gaseous Sulphur Compound Emission" at the University of Salford on 10, 11 and 12 April, 1973.

The programme will consist of six half day sessions covering the following topics:

Session 1: "The Nature of the Problem"

Four papers will examine the health aspects of atmospheric pollution, environmental factors affecting air pollution and prevailing attitudes in the U.K. and the U.S.A.

Session 2: "Recent Improvements in Claus Kiln Technology"

This will cover the Beavon process, the Clean Air Sulphur process, the I.F.P. gas cleaning process and the Sulfreen process.

Sessions 3 and 4: "Recent Advances in the Control of SO_2 emission"

Papers in these two sessions will cover fluidised bed combustion, dry limestone injection, the wet and dry Chemiebau processes, the Catox process, the Welman Lord process, the molten carbonate process and the Chemico MgO process.

Session 5: "Process for the removal of H_2S"

Four papers will discuss the S.N.P.A. diethanolamine process, the development of the Stretford process, the Giammarco Vetrocoke process and the vacuum carbonate process.

Session 6: This will consist of a general discussion at which short prepared contributions on any relevant technology will be welcome provided adequate notice is given.

The conference language will be English and full preprints will be sent to all those registering. The conference will be held in the new Chapman building of the University and accommodation will be available in the University Halls of Residence.

Full details about the conference and registration forms may be obtained from: Mr. N. E. Connor, Department of Chemical Engineering, The University of Salford, Salford M5 4WT, England.

Certificate Course in Biological Conservation

The Extramural Department of the University of Manchester in collaboration with the Biology Department of the University of Salford, is starting in January, 1973 a further course leading to a certificate in Biological Conservation. This course because of its nature, approximately 25 meetings per year to be held in the evenings, will be restricted for practical purposes to people living in the Northwest region. It is primarily intended for amateur naturalists who are working in conjunction with voluntary organisations and for people connected generally with aspects of environmental utilisation or planning.

Enrolments will be limited to 30, those intending to register for the course should write to either: Dr. John Powell, Department of Extra-Mural Studies, University of Manchester, Manchester M13 9PL; or to Dr. M. Pugh Thomas, Department of Biology, University of Salford, Salford.

Fuel Oil Firing Courses

The National Industrial Fuel Efficiency Services Ltd residential oil firing courses will be held at the Lancaster Gate Hotel, 106 Lancaster Gate, London W2 3NU and will take place as follows:

Course 2 22nd–25th January 1973.
Course 3 26th–29th March 1973.
Course 4 14th–17th May 1973.

The Fee for the course including accommodation and meals is £65.00.

For further information write: National Industrial Fuel Efficiency Service Ltd., 54/58 Bartholomew Close, London EC1A 7HD. Tel: 01-606 5906.

INDUSTRIAL NEWS

Bahco and Air Pollution in Sweden

The United Nations Anti-Pollution conference in Stockholm earlier this year underlined the enormous efforts that Sweden is putting into the purification of its environment. And yet, despite world-wide pre-occupation with anti-pollution during the past two years, it is not widely appreciated that Sweden has been conscious of the need to clean its air for over thirty years.

The purpose of this article is to show just how critical the problem of pollution is in Sweden, and how one company—Sweden's largest in the field—is helping to tackle just one section—air pollution.

The Problem

One might ask whether Sweden, with a population of about 8 million, distributed over an area comparable to that of France with its 96,000 lakes and forests covering some 53% of the country had any environmental problems worth mentioning.

One of the most characteristic developments in modern Sweden has been the increasing concentration of population in large towns. In 1900 30% of the population lived in towns, as opposed to 70% in 1960, and an estimated 90% by the year 2000.

It has been found that pollution created at home and drifting in from abroad contaminates soil and water. As in other industrialised countries, air pollution in Sweden has increased with expanding industry. The main sources of air pollution in Sweden listed in order of total emission are—internal combustion engines of motor vehicles, industry, heating, power generation and burning of solid waste.

Regular measurements show slow but steadiliy rising acidity of precipitation over the country; lakes and rivers become more acid with accompanying changes in the biological systems. Most Swedish soils are poorly equipped to counteract the acid rain. The increasing activity can be attributed to the effect of sulphur dioxide, and it is estimated that the equivalent of 4,000 tonnes of concentrated sulphuric acid is spread over the country every day; this is caused by the oxidisation of sulphurous acid formed by the combination of water and combusted sulphur in cheap heavy grade fuel oils.

During the past ten years the cost of metal corrosion has more than doubled in urban areas, and it is estimated at 2,000 million Sw. Kr. p.a. (approximately £167 million), much of this is due to increased pollution by sulphur dioxide, and an estimated one third of the total car corrosion cost is attributed to the increased acidity. Other effects of air pollution are deterioration of building materials such as limestone and concrete, textile deterioration and higher costs of cleaning and washing are even more expensive to society.

Against this background it is natural that the damage caused by sulphur dioxide in flue gases occupies a prominent position everywhere in air pollution discussions. However, it has proved difficult to get to grips with the problem. The Environmental Protection Board has issued instructions covering all aspects of air pollution, and oil containing more than 2.5 sulphur by weight may not now be used for heating in Sweden. The permitted sulphur content will be gradually reduced, starting in the major urban areas, and oil with more than 1% sulphur will not be burnt in these areas by 1975 and elsewhere in Sweden by 1980. The present availability of low sulphur content oils is limited. Desulphurization of the oil at the refinery is also undertaken, but for the oil suppliers this entails a sizeable investment in necessary equipment, and would take a long time to bring about.

The Environmental Protection Board has issued instructions on air pollution control emissions and construction standards for all important types of industry. New and existing plants are covered by these standards with the latter required to comply not later than June 30th, 1974.

The Swedish Government has clearly stated that its objectives in this field are to prevent further degradation, and to restore already damaged areas. 350.2 million Sw. Kr. (approximately £29 million) has been included in the national budget for environment protection in 1971/2, this compares with a figure of 162.4 m. Sw. Kr. (£13.5 million) in 1968/69, and 302 m. Sw. Kr. (£25 million) in 1970/71. Included in the 1971/72 figure is 50 m. Sw. Kr. for subsidies to industry for air and water pollution control, and 77 m. Sw. Kr. for research, which does not include grants made to universities.

An important achievement in the fight against air pollution has been made by AB Bahco, by producing a reliable and economically viable method of separating sulphur dioxide in oil heating plants. Called the Bahco SO_2 Scrubber, this cleaning device removes up to 98% of the sulphur dioxide in flue gases from boilers using heavy grade oil. At the same time, 90% of the flue dust is eliminated, therefore, the unit also operates as a highly effective dust collector.

The sulphur dioxide content in flue gas from a boiler using heavy oil is approximately 1,000 ppm. Using light oil, the sulphur dioxide content is only 300 ppm. With a Bahco SO_2 Scrubber installed it is possible to obtain a figure as low as 20 ppm, even when using heavy oil.

Cleaning is effected by the gas being washed with a lime solution in two consecutive stages. The sulphur dioxide and lime solution form a sludge consisting of calcium sulphite, hydrated calcium sulphate and water. This sludge also contains soot and other solid particles in the flue gases. It is harmless as regards handling and a refuse dump for the sludge does not constitute a nuisance.

Bahco's SO_2 Scrubber is intended for large heating plants, district heating and power stations, industrial boilers and other large-scale plants. Although developed primarily to collect sulphur dioxide it can also be used to advantage for other gases, including the hydrochloric acid that forms during the combustion of PVC plastic in refuse incinerators.

The first Bahco SO_2 Scrubbers were installed in 1970 in Stockholm's South Hospital.. The Sodersjukhus hospital is one of Europe's largest medical care complexes. An entire city within a city. The huge central heating plant serves both the hospital and a large part of the Sodermalm borough of Stockholm. Even when using oil with a low sulphur content in excess of 300 tonnes of sulphur dioxide and 20 tonnes of soot were spewed into the atmosphere every year. Bahco SO_2 Scrubbers have recently been installed, and although the plant now uses low priced heavy oil with a high sulphur content the amount of sulphur dioxide discharged is only 27 tonnes per year. Ash and soot have also been reduced to around 7 tonnes per year.

The Bahco Scrubber has been very successful in the international market. Licencing agreements have been concluded with Morubeni Iida Co. Ltd. of Tokyo, and with the Research Cottrell Inc. of New Jersey. The SO_2 Scrubber has been particularly successful in Japan. During the past 1½ years, there have been 8 installations in that country, and three in the United States.

Bahco Ventilation owes its prominent position in the world air cleaning market to its ability to offer a range of capital equipment designed to meet every requirement.

Other Bahco units which are frequently used by industry, are the Cascade Scrubber and the Multicyclone.

The CSD multicyclone is a dynamic dust separator for air and gas cleaning duties. It is characterised by high abrasion resistance and high separating efficiency, even with very fine grained dust. Furthermore the Multicyclone can be regulated to give enhanced separating ability with a reduced gas flow.

This characteristic is particularly valuable in flue gas cleaning and other applications where the load is liable to fluctuate.

The unit is built up of cyclone units with standardised dimensions each one capable of handling 630-900m³ of gas per hour. Standard batteries of twelve to 192 cyclone units are available.

The other unit—the Bahco Cascade Scrubber—is a wet separator for air and gas cleaning duties. Since it works on the principle of wet separation, it can be used to advantage on flammable or explosive dust. It can also be used in somewhat modified form—for recovery of heat and chemicals.

The Scrubber is constructed of unit tubes, each one capable of handling 2,500-3,300m³ of gas per hour.

The importance which the Swedish Government attaches to Anti-Pollution measures, is further reflected in the incentives which it is offering industry. For example, the Government is prepared to subsidise up to 75% of the cost of anti-pollution installations until mid-1973, 50 million Sw. Kr. (£4.1 million) having been budgetted annually.

Preservation of the environment is something the Swedes believe is worth paying for, and curricula are now being revised to bring more environmental education into all school levels. In 1970 an Environment Week was observed, its results are undergoing evaluation to see whether similar weeks should be a recurring feature of school work.

At post-secondary level all Swedish universities now offer a three month course on environmental problems and pollution control.

Further information on pollution in Sweden is given in "Environmental Protection in Sweden" published by the Swedish Institute, and Sweden's national report to the United Nations on the human environment, Ministry for Foreign Affairs, Stockholm 1971.

Details of Bahco equipment may be obtained from their U.K. office, at Ullswater Crescent, Coulsdon, Surrey.
Reader Enquiry Service No. **72121**

Evaluation of a Fuel Oil Additive

by T. R. Boyce, B.A.Sc., M.A.Sc., D.I.C., Ph.D., M.I.M.E., Professional Engineer

The author discusses the results of controlled tests to evaluate a fuel oil additive referred to in an article entitled Pollution from Boiler Stacks and Engine Exhausts—The Chemistry of Air Pollution and its solution by the Profit Factor by C. G. Henson, F.I. Plant Eng., M.I.E.I., M.S.M., in the Autumn 1971 *issue of "Clean Air".*

During the last quarter of 1971, we were requested by the Rolfite Company of Stamford, Conneticut, U.S.A., to conduct a series of tests at Imperial College of Science and Technology, to evaluate their products for use in heavy fuel oils, diesel oils and gasoline. Included in the test series was a comprehensive boiler trial employing the Mechanical Engineering Department's demonstration boiler.

This boiler shown in Fig. 1. is a typical small commercial design (6000 lbs. steam per hour, 200psig, 700°F superheat), and was of particular relevance to the Rolfite Company's activities, as it used a medium gravity, 3 per cent sulphur oil. The boiler, unlike many installations, had separate evaporator and superheater sections, each complete with their own burners. With this arrangement, independent control of water evaporation and steam superheat can be effected for experimental and teaching purposes.

The boiler was operated for a period of 72 hours with the steam produced at 5500 lbs steam per hour, 200 psig, and 600°F superheat to establish the comparative operating performance with untreated fuel. Prior to this period, the

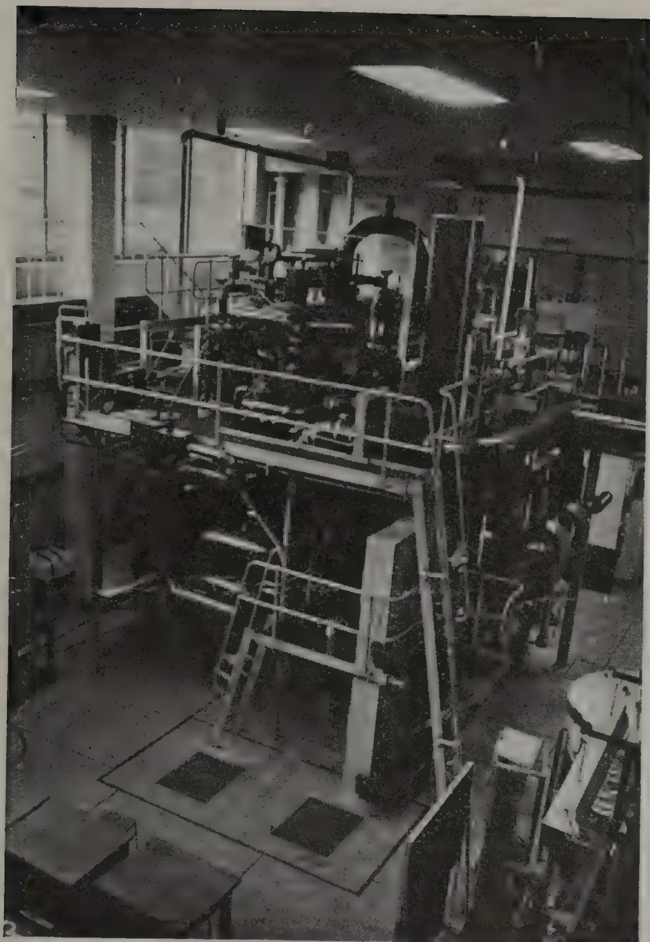


Fig. 1 Test Boiler at Imperial College of Science and Technology

burner jet sizes, fuel pressures and temperature and the forced draught flow were optimized to extract the highest possible boiler efficiency before employing the additive. In addition the boiler was fully instrumented to enable a complete thermal balance to be made, as well as to monitor the surface temperatures of the combustion chambers. Exhaustive stack gases analysis were also conducted and included surveys for oxides of Nitrogen, Sulphur Oxides, Carbon Monoxide, Carbon Dioxide, Oxygen, smoke density and particulate composition.

The test results completely vindicate the Rolfite Company's claims; proving their product to be particularly effective. Table 1 illustrates the boiler performance with and without the additive. The most significant other aspect of the trials was the complete reproducibility of the results, the boiler returning to baseline and additive test performance figures, after a rundown of approximately 30 hours in each case. Figure 2 illustrates the boiler response to the addition of Rolfite 404 @ 1:3000 V/V to fuel stream. In this case the burner pressures and temperatures were preset for use with Rolfite.

The Rolfite Additives are based upon an extremely complex formulation of Manganese Nitrogenates coupled with Amines to provide complete fuel conditioning and combustion catalyst properties in a single product. The effect of adding Rolfite to the fuel, in addition to the benefits claimed for fuel conditioning (i.e. homogenising, corrosion inhibition, etc.,), is to improve its burning characteristics by substantially reducing smoke formation by accelerating the conversion of carbon to carbon dioxide. The reaction mechanism by which this is achieved can be attributed to two different properties of the Rolfite complex. The first is better spray formation and reduced droplet size, due to the amines in the complex reducing the high pressure and temperature viscosity of the fuel. Due to this feature,

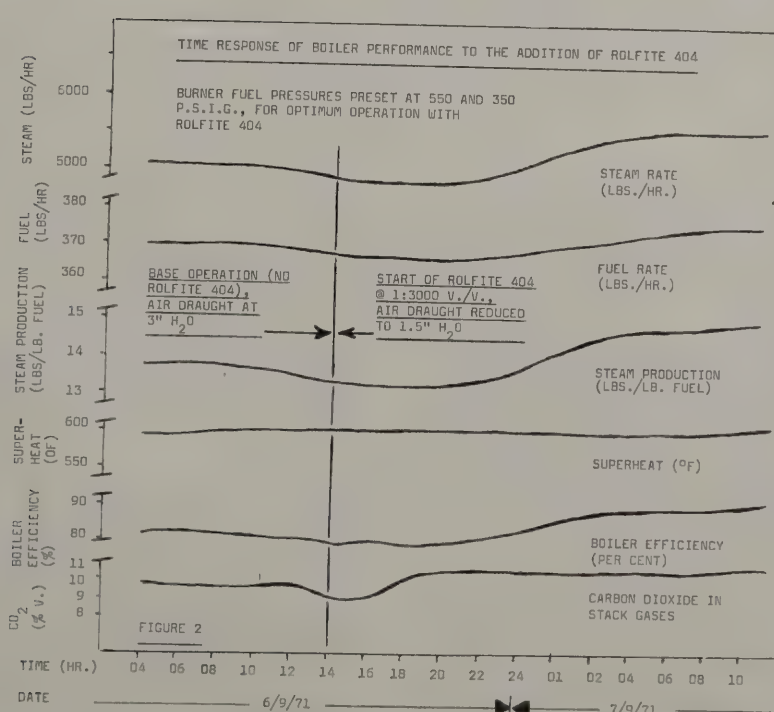


TABLE 1

	Boiler Operation No Additive	*Boiler Operation + Rolfite 404 @ 1:3000 V/V*	*Percent Change From Baseline*
Boiler Efficiency (%)	84·3	88·1	+ 4·5
Lbs Steam/hour	5435·8	5472·0	+ 0·7
Lbs Fuel/hour	391·7	377·3	− 3·7
Lbs Steam/lbs Fuel	13·9	14·5	+ 4·3
Average Fuel Pressure (Superheater) (psig)	450·0	350·0	−22·2
Average Fuel Pressure (Evaporator) (psig)	600·0	550·0	− 8·3
Average Fuel Temperature, (°F)	185·2	181·6	− 1·9
Average Smoke (Bacharach) Units	5·0	4·9	− 2·0
Average Carbon Dioxide (% V.)	10·5	10·8	+ 2·9
Average Oxygen (% V.)	3·4	3·0	−11·8
Sulphur Dioxide In Gases (ppm)	1270·0	1301·0	+ 2·5
Sulphur Trioxide In Gases (ppm)	90·0	53·9	−40·0
B.T.U.'s Supplied/lb. of Fuel	15757·0	16476·9	+ 4·6

Fig. 3. Burner Flame No Additive

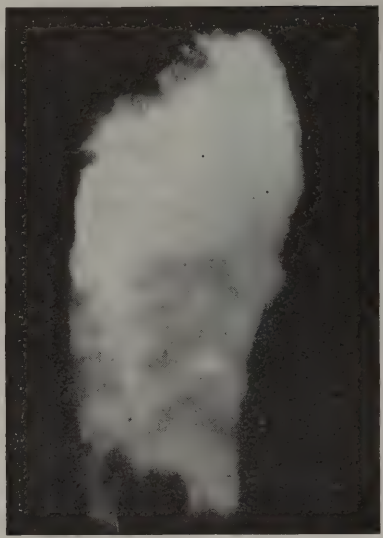


Fig. 4. Burner Flame Plus Rolfite 404 @ 1 : 3000 V/V. Overfiring due to Viscosity Reduction. No Trim

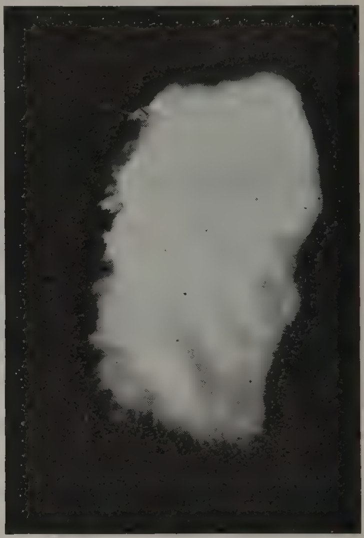


Fig. 5. Burner Flame Plus Rolfite 404 @ 1:3000 V/V Fuel Pressure, Temperature and Air Pressure Trimmed for Correct Firing

burner fuel pressures and temperatures invariably have to be re-adjusted to prevent overfiring when employing the additive (see lines 3, 4, & 5—Table 1 also photographs 3, 4 and 5). The second and most important aspect of Rolfite is the role of the Manganese Combustion Catalyst.

The use of Manganese as a combustion catalyst is well known, and incorporated in other proprietory fuel additives. However, Rolfite chemists have succeeded in formulating a unique form of Manganese complex which has proved to be far more effective, (on a weight for weight basis), than other forms of Manganese, and have thus avoided the problem of adding large quantities of extra "foreign" material to boiler combustion chambers.

The reaction mechanism by which this is achieved is attributable to thermal decomposition of the additive in the flame droplet zone; the metal oxides, (manganous oxide), being produced extremely quickly to act as surface catalysts to induce more complete oxidation of the hydrocarbon in the fuel. The Rolfite additive efficiency is enhanced by the fact that it oxidises via a multi-stage process involving successive oxidations of the Manganese complex, which greatly increase its surface area during the critical primary oxidation period of the main hydrocarbon fuel. The subsequent reduction in excess air required for combustion, with no increase in smoke number, is a significant factor in the operation of boilers to near stoichiometric combustion levels. It also improves control over low and high temperature corrosion by minimizing the formation of the corrosive higher oxides of vanadium and sulphur.

Boiler operation on untreated fuel containing sulphur, (usually 1.5 to 4%), results in the formation of SO_2 in the combustion chamber, of which 3 to 5 per cent is catalysed by the iron surfaces of the boiler tubes and the Vanadium pentoxide deposits from the combustion of the fuel, into SO_3. This compound is carried in the gas stream and readily combines with the water vapour produced during the combustion of the primary fuel at temperatures below 620°F to form Sulphuric Acid. As the gases cool,

they become saturated with Sulphuric Acid until, at about 320°F the acid dewpoint is reached:—below which the deposition of acid occurs. The quantity of acid deposition varies according to the metal temperature and the partial pressure of SO_3 in the gas stream.

The alleviation of the formation and deposition of Sulphuric acid in the boiler streams can be achieved by the selective use of Rolfite products, which inhibit the formation of SO_3 in the flame by forming sulphates of Manganese and Vanadium, and further reduce the formation of SO_3 from the remaining SO_2 by preventing the formation of Vanadium pentoxide, which is the primary SO_3 formation catalyst found in boilers. The net result of this complex mechanism is to substantially reduce the SO_3 concentrations which depresses the acid dewpoint of the gases, thus permitting lower 'back-end' temperatures in the boiler system while still maintaining 'dry' conditions throughout.

Experiences with these Rolfite products have shown the theoretical assumptions to be correct. Within a short period of time from the start of treatment and optimization of boiler operation, Sulphur trioxide concentrations drop dramatically. Sulphur dioxide levels on the other hand tend to rise above baseline levels until a peak is reached some two or three weeks after the start. From this point on, the concentration of SO_2 in the stack gases tends to drop approximately 20 per cent below baseline. This phenomena is attributable to a change in the chemical equilibrium existing between the flame formed SO_2 and those existing between as deposits within the boiler. With Rolfite, the production of SO_2 is lower than for untreated fuel, hence the reactions are biased towards the removal of the excess sulphur in the deposits. Stabilization of the concentrations usually occurs 6 to 8 weeks after start of treatment, whence the SO_2 emission remains consistently below baseline levels.

The obvious asset of lowering the back-end temperatures is that of higher boiler efficiency. In the Imperial College tests a gain of 4.5 per cent was achieved. In addition the reduction of fixed deposits which normally accumulate on the heat transfer surfaces, would lead to consistent higher performance figures over a much longer period of time.

Further substantiation of Rolfite's claims were evident upon visual inspection of the boiler combustion chamber and tubes after shutdown. A substantial quantity of old deposits had been unseated from the boiler tubes and deposited in the fly-ash trap in the stack, just before the economiser in the boiler. Fireside deposits were virtually nil, the boiler tube surfaces being covered only with a very thin coating of Manganese and Vanadium sulphates, which were dry, neutral in chemical activity, soft and easily removed with a compressed air blast.

Conclusion

Boiler operators today are faced with a multiplicity of conflicting requirements to satisfy the demand for economic efficient production of steam. On the one hand the ever rising demand for energy coupled with dwindling world fossil fuel reserves, is forcing the quality of low cost fuel stocks downwards, while environmentalists are attacking on the other hand to insist on rectifying pollution and 'fall-out' problems. Heavy fuel oils supplied are far from consistent in composition, viscosity and specific gravity, all of which tend to aggravate the problems associated with effective combustion.

These tests have shown that the use of the correct combustion promoting additive can facilitate complete combustion of heavier fuels and provide substantial fuel savings through higher combustion and boiler efficiencies. At the same time they reduce maintenance costs by giving a cleaner boiler with a marked reduction in high and low temperature corrosion. The decrease in fixed deposits would contribute to much longer periods of boiler operation at high efficiency, reduce the number of boiler outages, and shorten the downtime period. All this is effectively *at no extra cost to the consumer,* for fuel saving alone have on various installations provided a net saving of three per cent after paying for the product. The reduction in maintenance costs can be considered a pure profit.

Public concern with pollution has heightened the problems associated with Sulphur oxide emissions and political pressure has been brought to bear in some communities to enforce the use of low sulphur oils in spite of the enormous increase in fuel costs this implies. Alternatively, these tests have shown the added dividend of large reductions in sulphur oxides when burning a high sulphur oil.

Work is progressing on the total elimination of these oxides by altering the kinetics leading to their formation an biasing the reactions to form metalic sulphates which can be screened out by electrostatic precipitators. Development experiments have indicated that the ultimate goal of the combustion engineers and environmentalists can be reconciled: i.e. fuel and air in; Carbon Dioxide and water out; no toxic or corrosive fall out; and still maintain efficient production of power.

Reader Enquiry Service No. **72122**

New contract awarded to Esso Research Centre, Abingdon, by United States Environmental Protection Agency for continuation of studies on desulphurisation process

The United States Environmental Protection Agency has signed a further contract with Esso Petroleum Company to continue studies on a process which converts high sulphur heavy fuel oil into a low sulphur gas. The studies are to be carried out at the Esso Research Centre, Abingdon, Berkshire, where the process was invented. The contract is for £137,000 and runs for 18 months from June, 1972, bringing the total United States Government support for this project since June, 1970 to £250,000.

The process, called the Chemically Active Fluidised Bed—usually abbreviated to C.A.F.B.—consists of a shallow fluidised bed of lime particles, into which a high sulphur, heavy fuel oil is injected. The fuel oil is cracked and gasified by the high temperature lime bed, which is maintained at 850°C by the reaction between the fuel oil and the fluidising air. The lime bed removes almost all of the sulphur in the oil—90 per cent to 100 per cent desulphurisation is easily attained—and the hot gasified oil is then combusted in a slightly modified conventional burner unit with additional air to provide energy at a low level of sulphur emissions. A bonus is that the process also removes vanadium—a troublesome element which causes costly corrosion in boiler superheater tubes. Further details on the process are given in the section entitled "Chemically Active Fluidised Bed Process".

The CAFB Gasifier at Esso Research Centre, Abingdon.

The Environmental Protection Agency considers that the C.A.F.B. process shows good promise for reducing sulphur oxide emissions from large power stations burning the high sulphur heavy fuel oils which are essential to the economical production of electricity in the United States as well as in many other countries such as Britain. So far, results indicate that the C.A.F.B. process should offer some cost advantage over other means for reducing the burden of sulphur oxides in the air, although it is too early to make firm estimates in a development of this magnitude.

The total development programme is aimed at the conversion of a 100 megawatt power station in the United States. If this 100 megawatt conversion is as successful as expected it will provide the technical, engineering and economic data necessary to enable widespread adoption of the C.A.F.B. process as a means for reducing sulphur oxides pollution. The first applications are likely to be in the United States, but the information would also be available to enable it to be used in the United Kingdom and elsewhere.

The work necessary to develop the C.A.F.B. process to the stage of application of a 100 MW boiler is seen as a six phase programme, each phase providing a review step before deciding to proceed with the next. The new contract is for the second phase of the work, during which a continuous C.A.F.B. gasifier will be operated for about 2,500 hours at the Esso Research Centre, Abingdon, to provide data for a study design and economic evaluation of the process. The Abingdon pilot plant C.A.F.B. gasifier is of 10 million B.T.U./hr. capacity, equivalent to about 1 megawatt of power generation capacity, and was built by Esso during 1971 as part of the first phase of studies. In this first phase the gasifier operated for over 450 hours and gave excellent results.

Chemically Active Fluidised Bed Process

Crude petroleum and, of course, coal and natural gas, is of organic origin and it is an unfortunate fact of life that the organisms from which these fuels originated were made up of not only carbon and hydrogen, but also other elements, notably sulphur. Some fuel deposits are of a lower sulphur content than others, but practically none are entirely free from sulphur, not even natural gas, which often must be treated to remove gaseous sulphur compounds such as hydrogen sulphide. We are therefore left with the fact that if the community burns fuels of an organic origin, especially heavy residual fuels or coal, without taking some preventive action, sulphur oxides will be released into the atmosphere from the flue stack. Possible solutions to the problem are illustrated in Figure 1, for the case of a boiler.

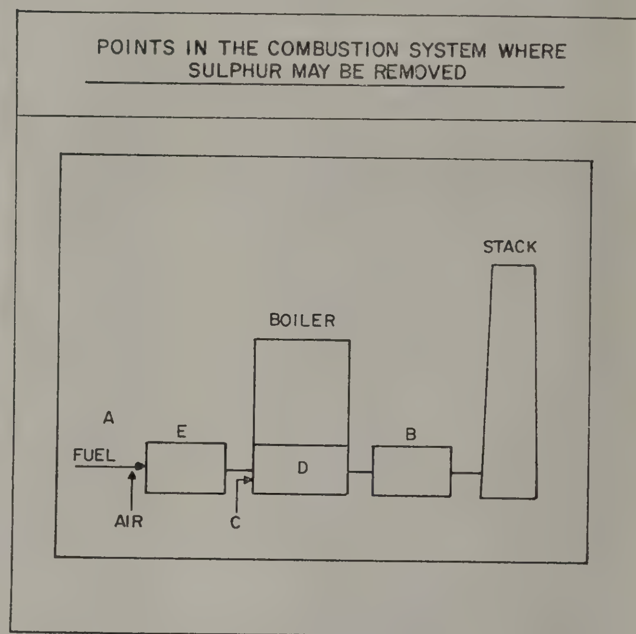


FIG. I.

Firstly a low sulphur fuel may be supplied at point A. To do this reserves of low sulphur petroleum crudes or coal sufficient to meet the demands of industry must be discovered, or as is more probable, the sulphur must be removed in some way before supplying it to the consumer. This can be done for oil, but is expensive. The organic sulphur in coal cannot be removed without turning the coal into a gas or liquid fuel.

A solution being studied by many research organisations is to put in some form of flue gas desulphurisation equipment at point B. The method has its attractions, but some drawbacks, not the least being that the entire volume of the flue gases must pass through the absorber without imposing too much back pressure. The equipment is therefore large and awkward to add on to existing boilers. Another approach is to inject additives into the combustion chamber at point C.

To be effective the additive must be highly active and very finely divided, so that it carries right through the boiler without blocking gas passages. It must then be cleaned out very thoroughly from the flue gases going to the stack. This method suffers from the relatively low chemical utilisation of the additive, which is not regenerated after use, and the cost of its preparation and handling in finely divided form.

A fourth approach is to use a modified form of the fluidised bed boiler. If the fluid bed material is made active towards sulphur, the advantages of improved heat transfer of the fluid bed can be combined with a method for removing sulphur at point D during combustion of the fuel. This is one form of the C.A.F.B. which was studied some time ago at the Esso Research Centre, Abingdon.

Useful though this approach is for new boilers, it would be slow to have a major effect on the environment, since there are so many existing conventional boilers, and for these, conversion to fluid bed combustion is impractical.

Finally, at point E the fuel may be gasified in a fluid bed, using a little of the air needed for full combustion, and the sulphur removed on the fluid bed material. The gasified fuel, stripped of its sulphur, can then be passed on to the boiler where it is completely burned with further air. It is this process applied at point E for the gasification and desulphurisation of heavy fuel oil which is the subject of the contract between the Environmental Protection Agency of the U.S. Government and Esso Petroleum Company Limited.

Figure 2 is a very simplified flow diagram of the process. Starting at the gasifier bed, air is blown into the bottom of a bed of granular solid of about 1 mm diameter. The bed material is lime, calcium oxide, which is a cheap and effective material for the purpose. The air bubbles through the bed, which behaves and moves rather like a liquid. Fuel oil is injected into the fluidised bed. In the fluid bed a complicated series of reactions takes place which result in the sulphur in the fuel oil becoming fixed on the lime bed as calcium sulphide. The sulphur free gas passes on to a burner, where it is completely burned with additional air.

CHEMICALLY ACTIVE FLUID BED GASIFIER

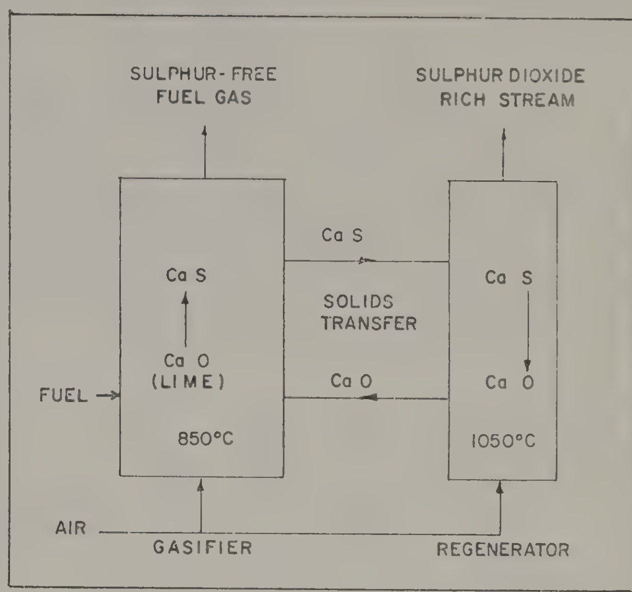
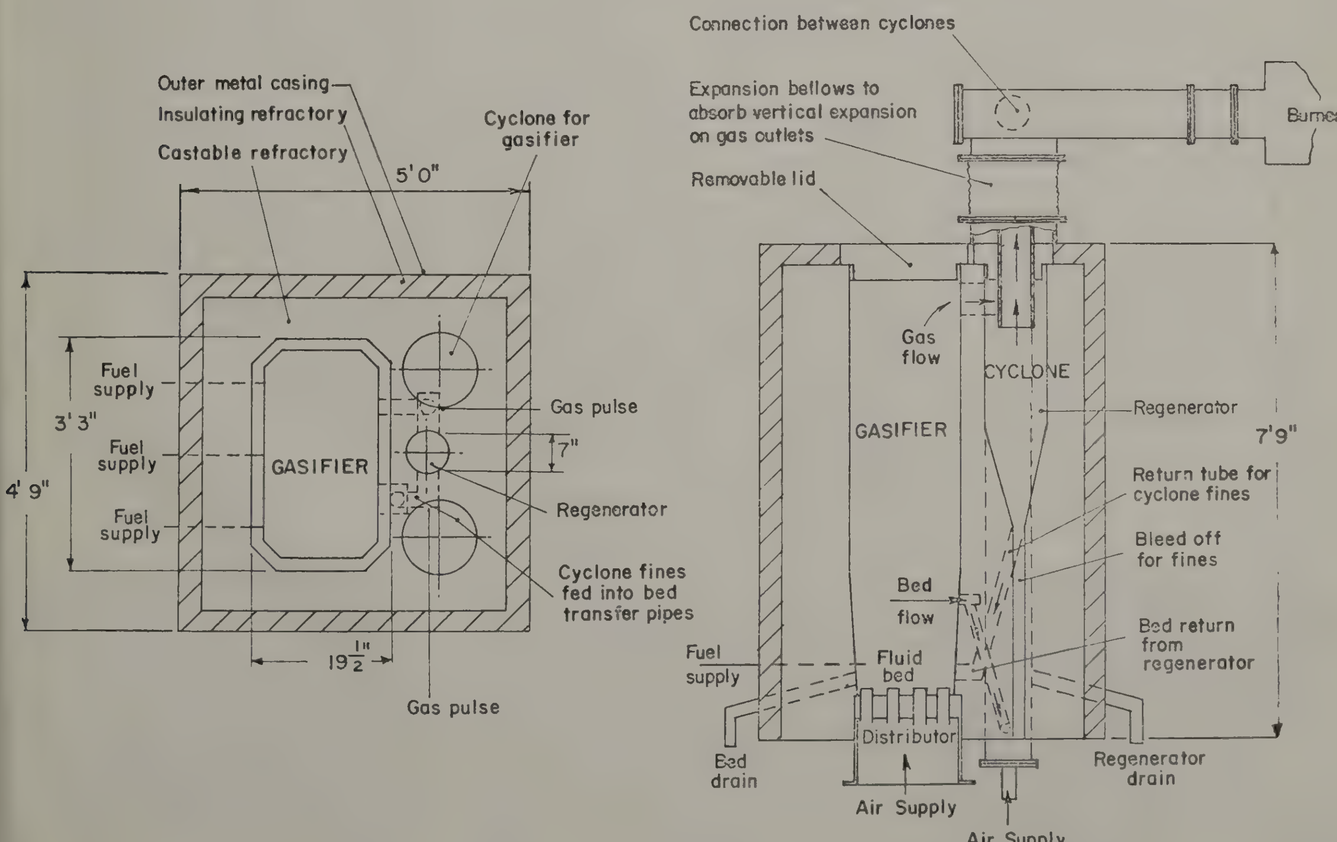


FIG. 2



LAYOUT OF CONTINUOUS GASIFIER UNIT

FIG. 3.

To maintain the desulphurising efficiency of the fluid bed material, a continuous flow of solids is maintained into a separate fluidised bed, where the lime is regenerated simply by blowing air through it. The gas produced in the regenerator contains a high proportion of sulphur dioxide, which may be removed in a number of ways, such as in a sulphuric acid plant. The calcium sulphide is almost completely converted back to the original reactive lime, and is returned to the absorber.

The optimum temperatures of absorption and regeneration are well within the established technology of major industries such as steel, lime and ceramics. Consequently there are no major problems of construction to meet these temperatures. The depth of the fluid bed needed to achieve high desulphurisation efficiencies is as little as 18 inches. Thus, even including the pressure drop through the distributor, the overall air pressure needed to operate the gasifier is well within that obtainable at a reasonable cost from centrifugal air blowers. The superficial gas velocity is low enough to avoid any major problem of attrition of bed material, and an important point is how little air is needed to operate the gasifier—20 per cent or less of the total air needed to completely burn the fuel needs to go through the fluid bed gasifier. Thus the gasifier can be moderate in size in relation to the boiler which it will feed—an important point when considering conversion of existing plant. A diagram of the C.A.F.B. gasifier is shown in Figure 3. A novel form of construction has been adopted to minimise heat losses from the fluid beds—the gasifier, regenerator and cyclones, and all of the gas and solid transfer ducts between them, are cast as holes in a monolithic block of refractory concrete.

So far the gasifier has operated for a total of over 450 hours, and has given excellent results. Total removal of sulphur is readily achieved, as is total retention of vanadium from the fuel oil. Optimum conditions, which include minimising consumption of limestone, give desulphurisation efficiencies of about 90 per cent.

Reader Enquiry Service No. **72123**

Controlling Lead in Vehicle Exhausts

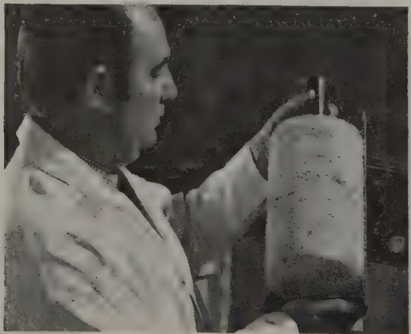
Dramatic reductions in the lead content of motor vehicle exhaust gases are promised by initial tests on a simple unit which could be fitted in place of the conventional silencer.

The lead trap, which could offer a practical alternative to severe reductions in the lead content in petrol, is the subject of a joint development programme involving two Tube Investments companies, T.I. Silencer Services Ltd., and Magnesium Elektron Ltd., with Texaco Ltd. and the Associated Octel Company Ltd., manufacturers of anti-knock compounds.

Independent bench and road tests of prototype units in this country and abroad have shown reductions of up to 70% in lead emissions, with no significant effect on vehicle performance, and suggest an effective life at least equal to that of present-day silencers.

A pilot plant has been built at the Manchester works of MEL to develop production techniques. Units from this plant will be used in an extensive series of road and dynamometer tests to be conducted by the Department of the Environment in co-operation with the Department of Trade and Industry.

The lead trap, which is based on principles patented by Texaco, consists of a sheet metal container packed with stainless steel wool which has been coated with alumina. Lead compounds which would otherwise pass through the exhaust system are trapped by a combination of chemical reaction with the alumina, adsorption and physical filtration.



Dimensions are comparable with those of the conventional silencers which the lead traps would replace, and there should be no difficulty in accommodating the units in new vehicles. It is hoped that traps can also be designed to be fitted to existing vehicles.

An important feature is that the silencing effect of the lead trap has been found to be at least as good as that of the conventional silencer.

Extensive tests have already been carried out, covering more than a million miles on the road and on road simulators at the Bletchley laboratories of Associated Octel. Independent tests of prototype units have also been made at the Warren Spring laboratory of DTI and at the German Rhine-Westphalia TUV laboratories.

These tests have shown overall reductions of between 50% and 70% in lead emissions and indicate that an effective life of up to 25,000 miles can be obtained.

Reader Enquiry Service No. **72124**

Air Sampling Unit by Thermal Control

The 1972 Spring issue of 'Clean Air', carried an editorial on an Air Sampling Unit by Thermal Control Co. Limited, of Hove, Sussex. The editorial is in the first columns of the 'Industrial News' section. Recent field exercises with this equipment produced the need for a faster and therefore simpler (method and type) membrane carrier. This need has now been satisfied and the open air sampling condition is now effected by using a self contained, pre-prepared membrane monitor unit from a sealed container. Thermal Control Co. Limited will be pleased to supply technical data on these new monitoring heads together with copies of associated literature.

Reader Enquiry Service No. **72125**

Largest single unit electrostatic precipitator to be built in the United Kingdom

The recently commissioned sinterstrand at the Corby Works, Tubes Division, of the British Steel Corporation is capable of producing 30,000 tons of sinter per week. It also produces 690,000 cfm of waste gases which have to be cleaned before being discharged to atmosphere.

These gases, which contain both abrasive grit and dust are treated in what is believed to be the largest single unit electrostatic precipitator ever to be built in this country. The gas cleaning plant, which was designed and installed by W. C. Holmes & Co. Ltd., gives an outlet dust burden not exceeding 0.05 grains per cubic foot of dry gas at normal temperature and pressure.

The collected dust is removed continuously from the collection hoppers by gravity, and is subsequently conveyed back to the sinterstrand for re-use.

Reader Enquiry Service No. **72126**

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